

ADDENDUM NO. 04

Date October 14, 2020

City of Austin

Project Name Ullrich WTP Low Service Pump Station Electrical Feed Renewal

C.I.P. No. 5335.016

IFB No.: CLMC822

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, dated September 7, 2020 (*first advertisement date*). **Acknowledge receipt of this addendum in space provided on bid form.** Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

1. Replace the Table of Contents with the attached section.
2. Replace Section 01143 – Coordination with Owner’s Operations with the attached section.
3. Add the attached Section 401S – Structural Excavation and Backfill.
4. Add the attached Section 408S – Concrete Joint Materials.
5. Add the attached Section 409S – Membrane Curing.
6. Add the attached Section 411S – Surface Finishes for Concrete.
7. Add the attached Section 432S – Portland Cement Concrete Sidewalks.
8. Add the attached Section 503S – Frames, Grates, Rings, and Covers.
9. Add the attached Section 506 – Manholes.
10. Add the attached Section 551 – Pipe Underdrains.
11. Add the attached Section 593S – P.C. Concrete Retards.
12. Add the attached Section 628S – Sediment Containment Dikes.
13. Add the attached Section 632S – Storm Inlet Sediment Trap.
14. Add the attached Section 634S – Level Spreader.
15. Add the attached Section 640S – Mortared Rock Wall.
16. Add the attached Section 660S – Biofiltration Medium.
17. Add the attached Section 661S – Soil Decompaction.
18. Add the attached Section 700S – Mobilization.
19. Add the attached Section 803S – Barricades, Signs, and Traffic Handling.

B. Drawing Revisions:

1. Replace Drawing C10-110 Storm Details (3 of 3) with the attached Drawing and as noted below.
 - Replaced TxDOT Metal Beam Guard Fence MBGF-19 Detail with Metal Beam Guard Fence Thrie-Beam Transition TL-3 Mash Compliant GF (31) TR TL3-19 Detail.
2. Replace Drawing C10-105 Site Details (2 of 4) with the attached Drawing and as noted below.
 - The Typical Single Slope Roadway Section with Retaining Walls Detail was modified to recognize the condition in which the roadway is the low elevation side of the wall with respect to the final grade outside of the roadway. The

detail now calls for a modified Thrie-Beam for this new condition. The Thrie-0Beam detail was added to sheet C10-110.

- 3.** Replace Drawing C30-101 LSPS Switchgear Enclosure and Access Drive Grading Plan (1 of 4) with the attached Drawing and as noted below.
 - LSPS Switchgear Enclosure and Access Drive Grading Plan (1 of 4) – The top of wall (TOW) and Bottom of Wall (BOW) elevations for retaining walls have been added. The BOW is defined in additional note #7. Dimensions for the expanded access drive section where Duct Bank Manholes 1A and 1B will be located were moved to be more legible.
- 4.** Replace Drawing C30-102 LSPS Switchgear Enclosure and Access Drive Grading Plan (2 of 4) with the attached Drawing and as noted below.
 - The top of wall (TOW) and Bottom of Wall (BOW) elevations for retaining walls have been added. The BOW is defined in additional note #7.
- 5.** Replace Drawing C30-103 LSPS Switchgear Enclosure and Access Drive Grading Plan (3 of 4) with the attached Drawing and as noted below.
 - The top of wall (TOW) and Bottom of Wall (BOW) elevations for retaining walls have been added. The BOW is defined in additional note #7. The elevation of the drainage grate was corrected.
- 6.** Replace Drawing C30-104 LSPS Switchgear Enclosure and Access Drive Grading Plan (4 of 4) with the attached Drawing and as noted below.
 - The top of wall (TOW) and Bottom of Wall (BOW) elevations for retaining walls have been added. The BOW is defined in additional note #7. Dimensions were provided for the expanded access drive section where Duct Bank Manholes 4A and 4B will be located.
- 7.** Replace Drawing S30-103 Structural Slab Plan with the attached Drawing and as noted below.
 - Removed retaining wall on plan north of building.
 - Changed note "Adjacent Retaining Wall by Others" to "Adjacent Retaining Wall – Ref S10-103".
 - Updated building elevation call outs to show 30S-107.
- 8.** Replace Drawing E00-008 Conduit and Wire Schedule Renovation (2 of 3) with the attached Drawing and as noted below.
 - Modified conduit/wire to match duct bank section.
- 9.** Replace Drawing E10-303 Duct Bank Section Proposed (3 of 9) with the attached Drawing and as noted below.
 - Changed conduit tag.
- 10.** Replace Drawing E10-306 Duct Bank Sections Proposed (6 of 9) with the attached Drawing and as noted below.
 - Changed conduit tag.
- 11.** Replace Drawing E10-308 Duct Bank Sections Proposed (8 of 9) with the attached Drawing and as noted below.
 - Added conduit fill to match conduit/wire schedule.

12. Replace Drawing E10-309 Duct Bank Sections Proposed (9 of 9) with the attached Drawing and as noted below.

- Added conduit fill to match conduit/wire schedule.

C. General:

1. Use the link below for access the Bid Opening.

- [CCO Web Bid Opening Click Here](#)

This addendum consists of 149 page(s)/sheet(s).



Approved by OWNER

Approved by ENGINEER/ARCHITECT (as applicable per license requirements)

END

Table of Contents

Document Number	Date	Title
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VOLUME 1

04/29/20	Table of Contents
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BIDDING REQUIREMENTS, CONTRACT FORMS, & CONDITIONS OF THE CONTRACT

00020	04/03/20	Invitation for Bids
00100	04/03/20	Instructions to Bidders
00220	03/30/18	Geotechnical Data
00300L	04/03/20	Lump Sum Bid Form
Total Bid Form	04/03/20	Total Bid Form
00400	04/30/19	Statement of Bidder's Experience
00405	03/30/18	Certificate of Non-Suspension or Debarment
00410	09/17/18	Statement of Bidder's Safety Experience
00440	10/22/19	Affidavit - Prohibited Activities
00475	08/12/19	Nonresident Bidder Provisions
00500	02/04/20	Agreement Section (Sample)
00610	02/04/20	Performance Bond
00620	02/04/20	Payment Bond
00630	10/22/19	Non-Discrimination and Non-Retaliation Certificate
00631	03/30/18	Title VI Assurances Appendix A
00632	03/30/18	Title VI Assurances Appendix E
00650	06/08/18	Certificate of Insurance
00670	01/11/19	Texas Sales and Use Tax Exemption Certificate
00680	03/30/18	Non-Use of Asbestos Affidavit (Contractor Prior to Construction)
00681	03/30/18	Non-Use of Asbestos Affidavit (Contractor After Construction)
00700	02/04/20	General Conditions of the Contract
00810	04/29/20	Supplemental General Conditions
00810A	09/17/18	Supplemental General Conditions-Federal Contract Provisions
00819	03/07/17	Security Requirements
00820	03/30/18	Modifications to Bidding Requirements
00830	02/04/20	Wage Rates and Payroll Reporting
00830BC	02/24/20	Wage Rates and Payroll Reporting-Building Construction Trades
00830HH	01/13/20	Wage Rates and Payroll Reporting-Heavy and Highway
00840	04/29/20	Construction Training Program Requirements
00900	01/11/19	Addendum (Sample)
WRD-255	01/17	Bidder's Certification
ED-103	09/26/16	Contractor's Act of Assurance
ED-104	10/06/16	Contractor's Act of Assurance Resolution

Table of Contents

SPECIFICATIONS**Division 1 - General Requirements**

01010	02/04/20	Summary of Work
01020	03/30/18	Allowances
01025	10/07/20	Measurement and Payment Lump Sum Contracts
01030	03/30/18	Alternates
01050	10/19/15	Grades Lines & Levels
01060	07/13/20	Special Conditions
01095	07/21/03	Reference Standards and Definitions
01096	05/06/11	Stormwater Pollution Prevention Plan (SWPPP)
01143	10/07/20	Coordination with Owner's Operations
01200	08/09/12	Project Meetings
01300	01/11/19	Submittals
01321	07/13/20	Construction Progress Schedule
01352	06/29/18	Sustainable Construction Requirements
01353	04/29/20	Construction Equipment Emissions Reduction Plan
01380	08/09/12	Construction Photography & Videos
01500	08/12/19	Temporary Facilities
01505	08/12/19	Construction and Demolition Waste Management
01550	08/09/12	Public Safety and Convenience
01595	08/14/14	Environmental Protection
01631	07/13/20	Product Substitutions
01670	04/30/14	Training
01700	07/13/20	Contract Closeout
01730	04/30/14	Operation and Maintenance Data
01792	07/13/20	Instruction for Operation and Maintenance Personnel
01900	03/12/12	Prohibition of Asbestos Containing Materials
01900a	06/05/06	Statement of Non-Inclusion of Asbestos Containing Material (E/A Prior to Design)
01900b	06/05/06	Statement of Non-Inclusion of Asbestos Containing Material (E/A After Design)

City Standard Technical Specifications

102S	08/20/07	Clearing and Grubbing
104S	09/26/12	Removing Portland Cement Concrete
110S	11/18/04	Street Excavation
111S	09/26/12	Excavation
130S	09/26/12	Borrow
132S	08/20/07	Embankment
201S	08/20/07	Subgrade Preparation
210S	02/24/10	Flexible Base
220S	02/24/10	Sprinkling for Dust Control
230S	08/20/07	Rolling (Flat Wheel)
232S	08/20/07	Rolling (Pneumatic Tire)
234S	08/20/07	Rolling and Tamping
236S	08/20/07	Proof Rolling
301S	08/20/07	Asphalts, Oils, Emulsions
306S	02/24/10	Prime Coat
312S	09/26/12	Seal Coat
340S	09/26/12	Hot Mix Asphaltic Concrete Pavement
360S	09/26/12	Concrete Pavement
401S	09/26/12	Structural Excavation and Backfill

Table of Contents

402S	11/13/07	Controlled Low Strength Material
403S	09/26/12	Concrete for Structures.
405S	11/13/07	Concrete Admixtures
406S	09/26/12	Reinforcing Steel
408S	11/13/07	Concrete Joint Materials
409S	11/13/07	Membrane Curing
411S	11/13/07	Surface Finishes for Concrete
420S	09/26/12	Drilled Shaft Foundation
430S	11/15/11	P.C. Concrete Curb and Gutter
432S	01/14/10	Portland Cement Concrete Sidewalks
503S	02/17/00	Frames, Gates, Rings and Covers
504S	02/24/10	Adjusting Structures
506	03/15/11	Manholes
508S	02/24/10	Miscellaneous Structures and Appurtenances
509S	09/26/12	Excavation Safety Systems
510	12/08/18	Pipe
511S	09/26/12	Water Valves
551	05/15/97	Pipe Underdrains
559S	10/03/13	Portland Cement Box Culverts
591S	01/04/16	Riprap for Slope Protection
593S	02/24/10	Concrete Retards
601S	11/14/16	Salvaging and Placing Topsoil
602S	06/16/08	Sodding for Erosion Control
604S	01/04/16	Seeding for Erosion Control
605S	06/21/07	Soil Retention Blanket
606S	06/21/07	Fertilizer
607S	05/23/00	Slope Stabilization Applications for Erosion Control
608S	09/26/12	Planting
609S	01/04/16	Native Grassland Seeding and Planting for Erosion Control
610S	12/07/18	Preservation of Trees and Other Vegetation
614S	10/07/20	Invasive Species Management
620S	01/04/16	Filter Fabric
621S	11/26/01	Diversion Temporary
625S	06/21/07	Temporary Grade Stabilization Structure
627S	09/26/12	Grass Lined Swale
628S	12/31/13	Sediment Containment Dikes
632S	11/26/01	Storm Inlet Sediment Trap
633S	11/26/01	Land Grading
634S	06/21/07	Level Spreader
639S	08/18/10	Rock Berm
640S	02/24/10	Mortared Rock Wall
641S	06/21/07	Stabilized Construction Entrance
642S	09/01/11	Silt Fence
648S	08/18/10	Mulch Sock
658S	04/04/12	Void and Water Flow Mitigation
660S	01/14/16	Biofiltration Medium
661S	11/14/16	Soil Decompaction
700S	09/26/12	Mobilization
701S	09/26/12	Fencing
702S	05/20/02	Removal and Relocation of Existing Fences
704S	09/26/12	Metal Beam Guard Railing
706S	09/29/99	Bridge and Culvert Railing
722S	09/26/12	Protective Coatings
725S	09/26/12	Survey Markers
802S	09/26/12	Project Signs
803S	11/15/11	Barricades, Signs and Traffic Handling

Special Provisions to City Standard Technical Specifications

SP00819	10/05/2020	Security Requirements
SP420S	07/13/20	Drilled Shaft Foundation
SP609S	07/13/20	Native Seeding and Planting for Restoration

Special Specifications**Division 2 – Site Work**

02072	07/13/20	Cutting and Patching
02220	07/13/20	Demolition
02442	10/07/20	Dewatering
02466	07/13/20	Drilled Concrete Piers and Shafts

Division 3 - Concrete

03300	07/13/20	Cast-in-Place Concrete
03392	06/26/20	Penetrating Concrete Sealant
03462	07/13/20	Precast Concrete Vaults

Division 4 - Masonry

04211	06/26/20	Brick Masonry
04810	06/26/20	Unit Masonry Assemblies

Division 5 – Metals

05120	07/13/20	Structural Steel Framing
05210	07/13/20	Steel Joist Framing
05310	07/13/20	Steel Decking

Division 6 – Wood, Plastics, and Composites

06100	06/26/20	Rough Carpentry
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Division 7 – Thermal and Moisture Protection

07210	06/26/20	Building Insulation
07220	06/26/20	Roof Insulation
07411	06/26/20	Standing-Seam Metal Roof Panels
07620	06/26/20	Sheet Metal Flashing and Trim
07920	06/26/20	Joint Sealants

Division 8 - Openings

08110	06/26/20	Steel Doors and Frames
08330	06/26/20	Insulated Overhead Coiling Doors
08411	06/26/20	Aluminum Framed Windows
08711	06/26/20	Finish Hardware
08800	06/26/20	Glazing

Division 9 - Finishes

09900	06/26/20	Painting
-------	----------	----------

Table of Contents

Division 10 - Specialties

10400	07/13/20	Identification Devices
10441	06/26/20	Fire Extinguishers

Division 11 – Equipment

11005	07/13/20	Equipment: Basic Requirements
-------	----------	-------------------------------

Division 13 – Special Construction

13851	07/13/20	Fire Alarm System
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Division 15 - Mechanical

15050	07/13/20	Heating, Ventilation, and Air Conditioning
15053	07/13/20	Common Motor Requirements for HVAC Equipment
15060	07/13/20	Sleeves and Sleeve Seals for HVAC Piping
15061	07/13/20	Escutcheons for HVAC Piping
15062	07/13/20	Hangers & Supports for HVAC Piping and Equipment
15074	07/13/20	Vibration Controls for HVAC
15077	07/13/20	Identification for HVAC Piping and Equipment
15082	07/13/20	HVAC Piping Insulation
15083	07/13/20	Duct Insulation
15180	07/13/20	Condensate Piping
15183	07/13/20	Refrigerant Piping
15738	07/13/20	Split-System Air Conditioning Units
15815	07/13/20	Metal Ducts
15816	07/13/20	Flexible Ducts
15820	07/13/20	Air Duct Accessories
15838	07/13/20	HVAC Power Ventilators
15855	07/13/20	Air Diffusers
15856	07/13/20	Registers and Grilles
15950	07/13/20	Vibration Controls for HVAC

Division 16 - Electrical

16044	10/07/20	5KV and 15KVMetal-Clad Switchgear and Medium Voltage Overhead Bus Ducts
16140	07/13/20	Switchboards
16150	07/13/20	Raceways, Fittings, and Supports
16182	07/13/20	Medium Voltage Cables
16200	07/13/20	Wiring (600 Volts and Below)
16250	07/13/20	Boxes and Cabinets
16264	07/13/20	480 Volt Uninterruptible Power Supply
16300	07/13/20	Wiring Devices
16350	07/13/20	Lighting
16450	07/13/20	600 Volts and Below Dry-Type Transformers
16480	07/13/20	Over 600 Volts Dry-Type Transformers
16500	07/13/20	Panelboards
16524	07/13/20	480 Volt Automatic Transfer Switch
16550	07/13/20	Grounding
16600	07/13/20	Disconnect Switches and Enclosed Circuit Breakers
16800	07/13/20	Calibration, Testing, and Settings

Division 17 – Instrumentation and Control

Table of Contents

17100	07/13/20	Process Instrumentation and Control Systems (PCIS)
17200	07/13/20	Instrumentation and Control Cabinets and Associated Equipment
17380	07/13/20	Field Instrumentation and Sensing Devices
17600	10/07/20	Distributed Control System

VOL. 2 of 2 03/01/17 **MBE/WBE Procurement Program Package**

END

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for coordinating with Owner's operations during the Project.
2. Requirements for tie-ins and shutdowns necessary to complete the Work without impact on Owner's operations except as allowed in this Specifications section.

B. Scope:

1. Contractor shall provide all labor, materials, equipment, tools, and incidentals shown, specified, and required to coordinate with Owner's operations during the Work in accordance with this Specifications section.
2. Except for shutdowns specified in this Specifications section, perform the Work such that Owner's facilities remain in continuous, satisfactory operation during the Project. Schedule and perform the Work such that the Work does not: impede Owner's production or processes, create potential hazards to operating equipment and personnel, reduce the quality of the facility's products or effluent, cause odors or other nuisances, does not affect the public health, safety, welfare, and convenience, and does not adversely affect the environment resulting in violation of Laws or Regulations.
3. Work not specifically addressed in this Specifications section or in referenced sections may, in general, be performed, to be completed within the Contract Times, at any time during regular working hours in accordance with the Contract Documents, subject to the requirements in this section.

C. Related Requirements: Include but are not necessarily limited to:

1. Section 01010 - Summary of Work.
2. Section 02072 - Cutting and Patching.

1.02 REFERENCES

A. Terminology:

1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this Specifications section have the meaning indicated below:
 - a. The term "Owner" is used throughout this section. When the facility is operated or managed by an entity other than Owner, references in this section to "Owner" as the operator or manager of the facility will be interpreted as referring to the facility manager.

- b. A "shutdown" is when a portion of the normal operation of Owner's facility, whether equipment, systems, conduit (including piping and ducting), has to be temporarily suspended or taken out of service to perform the Work.
- c. A "tie-in" is a connection of new Work to existing facilities, including connecting to existing conduits (including piping and ducting), electrical systems, structural elements, process/mechanical elements, and other physical connections. Some tie-ins may require that the tie-in be made without an associated shutdown.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Review construction procedures under other Specifications sections and coordinate Work that will be performed with or before the Work indicated in this Section.

B. Sequencing and Scheduling:

- 1. Refer to this Specifications sections articles on sequencing, tie-ins, and shutdowns.

1.04 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Shutdown Planning Submittal:

- a. For each shutdown, submit an inventory of labor, materials, and equipment required to perform the shutdown and tie-in tasks, an estimate of time required to accomplish the complete shutdown including time for Owner to take down and start up existing equipment, systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.
- b. Furnish submittal to Engineer not less than 60 days prior to proposed shutdown start date. Do not start shutdown until obtaining Engineer's acceptance of shutdown planning Submittal.

2. Shutdown Notification:

- a. After Engineer's acceptance of shutdown planning Submittal and prior to starting the shutdown, submit written notification to Owner and Engineer of date and time each shutdown is to start. Submit notification not less than 4 weeks in advance of each shutdown.

1.05 GENERAL CONSTRAINTS

- A. Indicated in the Contract Documents are the sequence and shutdown durations, where applicable, for Owner's equipment, systems, and conduits (including piping and ducting) that are to be taken out of service temporarily for the Work. New materials and equipment may be used by Owner after the specified field quality control activities are successfully completed and the materials or equipment are substantially complete in accordance with the Contract Documents.

- B. The following constraints apply to coordination with Owner's operations:
1. Operational Access: Owner's personnel shall have access to equipment and areas of the facility that remain in operation.
 2. Temporary Partitions and Enclosures: Provide temporary partitions and enclosures necessary to maintain dust-free, heated, and ventilated spaces in areas of the facility that are adjacent to the Work and that must be kept operational. Comply with Section 01500 -Temporary Facilities.
 3. Dead End Valves or Conduits:
 - a. Provide blind flanges, watertight bulkheads, or valve at temporary and permanent terminuses of conduits, including piping and ducting.
 - b. Blind flanges and bulkheads shall be suitable for the service and braced and blocked, as required, or otherwise restrained as necessary or as required by Engineer.
 - c. Temporary valves shall be suitable for their associated service. Where valve is provided at permanent terminus of conduit, including piping or ducting, also provide on downstream side of valve a blind flange with drain/flushing connection.
 4. Owner will assist Contractor in dewatering process tanks, basins, conduits, and other work areas to be dewatered for shutdowns. Maintain clean, dry work area by pumping and properly disposing of fluid and other material that accumulates in work areas.
 5. Draining and Cleaning of Conduits, Tanks, and Basins:
 - a. Unless otherwise shown or indicated in the Contract Documents, Contractor shall dewater process tanks, basins, conduits (including piping) at beginning of each shutdown. Flush, wash down, and clean tanks, basins, conduits (including piping), and other work areas.
 - b. Contractor shall remove liquids and solids and dispose of them at appropriate location at the Site as directed by Engineer. Unless otherwise specified or indicated, contents of tanks, basins, and conduits (including piping) undergoing modifications shall be transferred to existing process tanks or conduits at the Site with capacity sufficient to accept such discharges, using hoses, temporary piping, temporary pumps, and other means provided by Contractor. Discharge of fluids across floors is not allowed.
 - c. If drainage point is not available on the conduit (including piping) to be drained, provide a wet tap using tapping saddle and valve or other method approved by Engineer. Uncontrolled spillage of contents of conduits (including piping) is not allowed.
 - d. Spillage shall be brought to Engineer's attention immediately, both orally and in writing, and reported in accordance with Laws and Regulations. Contractor shall wash down spillage to floor drains or sumps or other appropriate location and flush the system to prevent clogging and odors. If spillage is not suitable

for discharge to the drainage system, such as chemical spills, as determined by Engineer, Contractor shall remove spillage by other means, such as vacuum truck, sorbents, or other method acceptable to Engineer.

6. Depending on seasonal demand, or other service outages, the Owner may request a delay of proposed shutdown dates.

1.06 WORK COVERED BY CONTRACT

A. The Work of this Contract under the Base Bid generally includes the following Project Classified Systems (PCS's):

1. PCS #1: Electrical Substation No. 4 (SUB4)
 - a. Construct building with all associated structural and geotechnical work
 - b. Installation of electrical, instrumentation and control, security, telecommunication, fire alarm and HVAC systems at SUB4.
 - c. Connection to Austin Energy service
2. PCS #2: Existing Low Service Pump Station (LSPS)
 - a. Sequenced demolition of existing electrical distribution equipment and support structure
 - b. Sequenced installation of new electrical distribution equipment and support structure
3. PCS #3: Ductbank Installation from SUB4 to the LSPS
 - a. Construct new ductbank and manhole system from SUB4 to LSPS
 - b. Installation of medium voltage and fiber optic cables
4. PCS #4: Powder Activated Carbon (PAC) Building Electrical Feed
 - a. Construct new ductbank and manhole system from SUB4 to PAC
 - b. Installation of medium voltage cables
 - c. Installation of new service transformer
 - d. Demolition of existing service transformer

1.07 SEQUENCE OF WORK

A. General Notes:

1. Perform the Work in the indicated sequence. Certain phases or stages of the Work may require working 24 HR days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if Owner's

operations are not adversely affected by proposed substitute sequence, with Engineer's approval. Stages specified in this article are sequence-dependent.

2. The intent of these construction sequence documents is to outline the proposed sequence of construction required to complete the demolition/modification/installation of existing and proposed medium voltage feeders, proposed Substation No. 4 and existing and proposed electrical equipment throughout the Ullrich Water Treatment Plant as set forth by this set of contract documents. Not all work items depicted in the contract documents are described in this construction sequence documents. This in no way relieves the contractor of the responsibility of completing all work depicted in this set of contract documents. The full scope of work required is contained within the complete set of contract documents.
3. When a power outage to a facility is required, the contractor shall request such an outage in writing no less than one month in advance of the required outage. The contractor's written request shall identify the desired date, time duration, and purpose of the requested outage. The contractor shall not proceed with the outage unless he/she obtains a written approval from the owner authorizing the outage. The owner reserves the right to modify or reject any request for such an outage. Modification or rejection of the contractor's request by the owner shall not be considered reason for delays in the construction schedule. Unless otherwise noted, the duration of any outage shall be limited to four (4) hours or less. The owner reserves the right to limit the duration of the outage to less than four (4) hours. Modifications of the outage duration by the owner shall not be considered reason for delays in the construction schedule.
4. The contractor shall take care to avoid damage to existing facilities. If any existing facilities are damaged in the course of construction of any part of this contract, the contractor shall repair the damaged facilities to their original operating condition immediately, with repair crews working twenty-four (24) hours per day until the damage is repaired, at no additional cost to the owner.
5. The contractor shall be aware that the age and condition of some of the plant's existing electrical distribution equipment may impact operation of circuit breakers and/or switches within the equipment as well as the sequence of operation proposed within the construction sequence documents. Therefore, prior to operating any circuit breakers and/or switches in existing electrical distribution equipment, the contractor shall coordinate proposed switching strategies and procedures with the plant and with Austin Water's electrical services division.

B. Stage I -Proposed Switchgear Building:

1. Equipment to be demolished:
 - a. Existing 16 INCH Water Line inside of the building footprint
2. Equipment to be installed:
 - a. 16 INCH Water Line relocation
 - b. Switchgear Building

- c. Furnish and install all electrical, controls, and instrumentation equipment within and surrounding the proposed Switchgear Building
- 3. Raceway and cables to be installed:
 - a. Interconnection to Austin Energy.
- C. Stage II – Powder Activated Carbon Building Renovations
 - 1. Equipment to be demolished:
 - a. Transformer "Transformer No. 11"
 - 2. Equipment to be installed:
 - a. Transformer "PAC-XFMR-01"
 - 3. Raceway and cables to be installed:
 - a. Between the proposed Switchgear Building and the existing PAC building.
- D. Stage III - Service to LSPS 4160V Motor Control Centers:
 - 1. Equipment to be demolished:
 - a. None
 - 2. Equipment to be installed:
 - a. None
 - 3. Raceway and cables to be installed:
 - a. Between the proposed Switchgear Building and Manholes "MH-4A" and "MH-4B"
 - b. Duct bank and exposed conduit extending from Manholes "MH-4A" and "MH-4B" and 4160V motor control centers "LSPS-MCC-002" and "LSPS-MCC-003".
- E. Stage IV – LSPS 480V Distribution Equipment Part 1
 - 1. Equipment to be demolished:
 - a. 12.47kV:4.16kV Transformer "SUB3-XFMR-02"
 - b. 4.16kV Switchgear "BUS-B"
 - c. 480V Automatic Transfer Switch "LSPS-XSW-ATS1"
 - d. 480V Panelboard "LSPS-PP-001A"
 - 2. Equipment to be installed:

- a. 12.47kV:480V Transformer "LSPS-XFMR-01"
 - b. 480V Switchboard "LSPS-SWBD-01"
 - c. 480V Panelboard "LSPS-PANEL-03"
 - 3. Raceway and cables to be installed:
 - a. Duct bank between "MH-4A" and Transformer "LSPS-XFMR-01"
 - b. Duct bank between "LSPS-SWBD-01" and panelboard "LSPS-PANEL-03".
 - 4. Notes:
 - a. Panelboard "LSPS-PANEL-03" to be temporarily served from Breaker "BKR-SWBD4" in switchboard "LSPS-SWBD-01".
 - b. Transfer loads from existing panelboard "LSPS-PP-001A" to proposed panelboard "LSPS-PANEL-03".
- F. Stage V - LSPS 480V Distribution Equipment Part 2
- 1. Equipment to be demolished:
 - a. 4.16kV:480V Transformer "LSPS-XFMR-002"
 - 2. Equipment to be installed:
 - a. 480V Switchboard "LSPS-SWBD-03"
 - 3. Raceway and cables to be installed:
 - a. Duct bank between "LSPS-SWBD-01" and switchboard "LSPS-SWBD-03".
 - 4. Notes:
 - a. Transfer loads from existing switchboard "LSPS-PWRC-001" to proposed switchboard "LSPS-SWBD-03".
- G. Stage VI - LSPS 480V Distribution Equipment Part 3
- 1. Equipment to be demolished:
 - a. 12.47kV Switchgear "BUS 1" and "BUS 2"
 - b. 12.47kV:4.16kV Transformer "SUB-XFMR-01"
 - c. 4.16kV Switchgear "BUS-A"
 - d. 4.16kV:480V Transformer "LSPS-XFMR-001"
 - e. 480V Switchboard "LSPS-PWRC-001"

2. Equipment to be installed:
 - a. 12.47kV:480V Transformer "LSPS-XFMR-02"
 - b. 480V Switchboard "LSPS-SWBD-02"
 - c. 480V Switchboard "LSPS-ATS-01" and "LSPS-ATS-02"
 - d. 480V Switchboard "LSPS-SWBD-04"
 - e. 480V Switchboard "LSPS-SWBD-05"
 - f. 480V Switchboard "LSPS-SWBD-06"
 - g. Remote I/O Cabinet "LSPS-COMMPANEL-03"
3. Raceway and cables to be installed:
 - a. Remainder of duct bank shown on Drawing No. E10-116.
4. Notes:
 - a. Furnish and install permanent feeders to panelboard "LSPS-PANEL-03".
 - b. Re-fed loads previously served from existing switchboard "LSPS-PWRC-001" to proposed switchboards "LSPS-SWBD-04", "LSPS-SWBD-05", and "LSPS-SWBD-06".

H. Stage VII – Completion of Work

1. Complete all other work events, in their entirety and as set forth in this set of contract documents, which have not been outlined within these construction sequencing documents.

1.08 TIE-INS

- A. Table 01143-A in this Specifications section lists connections by Contractor to existing facilities. Table 01143-A may not indicate all tie-ins required for the Work; Contractor shall perform tie-ins necessary and required to complete the Work as shown or indicated in the Contract Documents, regardless of whether tie-in is indicated in Table 01143-A. For tie-ins not indicated in Table 01143-A, obtain requirements for tie-ins from Engineer by requesting an interpretation or clarification.

PART II - PRODUCTS – (NOT USED)

PART III - EXECUTION

3.01 SUBSTITUTE PROCEDURES

- A. Proposal of Substitute Sequencing, Shutdowns, and Tie-Ins:
 1. As a substitute to the procedures indicated in this Specifications section, Contractor may propose providing additional temporary facilities that can eliminate or mitigate

a constraint without additional cost to Owner, provided such additional temporary facilities: do not present hazards to the public, personnel, structures, and equipment; that such additional temporary facilities do not adversely affect Owner's ability to comply with Laws and Regulations, permits, and operating requirements; that such temporary facilities do not generate or foster the generation of odors and other nuisances; and that requirements of the Contract Documents are fulfilled.

2. Engineer will consider proposals for substitute procedures after the Effective Date of the Contract. All Bids shall be based on the requirements of the Contract Documents, including this section.
3. Substitution Requests:
 - a. When proposing a substitute procedure for a tie-in or shutdown or other requirements of this section, comply with the requirements of the General Conditions and Supplementary Conditions (regarding substitutes) and Section 01640 - Substitution Procedures.
 - b. When deviation from specified sequence or procedures is proposed, Contractor's proposal shall explain in detail the proposed sequence and procedures and associated effects, including evidence that Owner's operations will not be adversely affected, to an extent greater than originally contemplated in the Contract Documents, by proposed substitution. List benefits of proposed substitution, including benefits to Progress Schedule.

3.02 GENERAL PROVISIONS FOR COORDINATING WITH OWNER'S OPERATIONS

- A. When possible, combine multiple tie-ins into a single shutdown to reduce impacts on Owner's operations and processes.
- B. Operation of Existing Systems and Equipment during the Work:
 1. Do not shut off or disconnect existing operating systems or equipment, unless accepted by Engineer in writing.
 2. Operation of existing systems and equipment will be by Owner unless otherwise specified or indicated.
 3. Where necessary for the Work, Contractor shall seal or bulkhead Owner-operated gates and valves to prevent leakage that may affect the Work, Owner's operations, or both.
 4. Provide temporary watertight plugs, bulkheads, and line stops as necessary and as required. After completing the Work, remove seals, plugs, bulkhead, and line stops to satisfaction of Engineer.
- C. Bypassing:
 1. Diversion of flows around treatment processes is not allowed.
- D. Performing the Work of this section constitutes Contractor's approval of underlying work and field conditions prevailing at the time of the Work.

3.03 PREPARATION

- A. Coordinate preparations for removals with requirements of Section 02072 - Cutting and Patching, applicable.
- B. Shutdowns - General Preparation:
 - 1. Coordinate shutdowns with Owner and Engineer.
 - 2. Submit shutdown planning Submittals and shutdown notification Submittals in accordance with this Specifications section's "Submittals" Article.
 - 3. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, materials, equipment, spare parts, both temporary and permanent, necessary to successfully perform the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to commencing the associated shutdown. Demonstrate to Engineer's satisfaction that Contractor has complied with such requirements before commencing the shutdown.
 - 4. Engineer shall have no duty to Contractor to advise Contractor of inadequate preparations by Contractor; Contractor is solely responsible for the means, methods, procedures, techniques, and sequences of construction.
- C. Shutdowns of Electrical Systems:
 - 1. Comply with Laws and Regulations, including the National Electric Code.
 - 2. Contractor shall lock out and tag circuit breakers and switches operated by Owner and shall verify that affected cables and wires are de-energized to ground potential before starting other Work associated with the shutdown.
 - 3. Upon completion of shutdown Work, remove the locks and tags and advise Engineer or Resident Project Representative (RPR) that facilities are available for use.

3.04 ATTACHMENTS

- A. The following, bound after this Specifications Section's "End of Section" designation, are part of this Specifications Section:
 - 1. Tables:
 - a. Table 01143-A, Schedule of Tie-ins (1 pages).

END

DIVISION 1 - GENERAL REQUIREMENTS
COORDINATION WITH OWNER'S OPERATION
01143

Table 01143-A Schedule of Tie-Ins					
Tie-In No.	New Line Size and Service	Existing (Connecting) Line Size & Service	Tie-In Building/Location	Construction Stage	Remarks
1	16 INCH Water Line	16 INCH Water Line	Low Service Pump Station Switch Gear Building (Substation No. 4)	Stage 1	Allowable Shutdown Time: 48 HRS
2	16 INCH Water Line	16 INCH Water Line	Stations 2+81 and 4+89 of PAC duct bank	Stage 1 or 2	2 locations – contractor may perform simultaneous with Tie-In 1 above
3					
4					
5					
6					

ITEM NO. 401S - STRUCTURAL EXCAVATION AND BACKFILL 9-26-12**401S.1 - Description**

This item shall govern the excavation for placement of structures, except pipe sewers, the disposal of such excavated material and the backfill around completed structures to the level of the original ground or grade indicated on the Drawings. The work shall include all necessary pumping or bailing, sheathing, drainage, and the construction and removal of any required cofferdams. Unless otherwise indicated on the Drawings, the work included hereunder shall provide for the removal of old structures or portions thereof (abutments, buildings, foundations, wingwalls, piers, etc.), trees and all other obstructions necessary to the proposed construction.

Where excavation is not classified, it will be grouped under "Unclassified Structural Excavation", which shall include the removal of all materials encountered regardless of their nature or the manner in which they are removed.

Where excavation is classified, it shall be classed as "Common Structural Excavation" or "Rock Structural Excavation" in accordance with the following criteria:

"Common Structural Excavation" shall include the removal of all materials other than rock.

"Rock Structural Excavation" shall include the removal of firm and compact materials that cannot be excavated with power equipment, without first being loosened or broken by blasting, sledging or drilling.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

401S.2 - Submittals

The submittal requirements of this specification item may include:

Supplier and certified test results for fine aggregate/sand material

Supplier and certified test results for flexible base material

Mix design and test results for lime stabilized subgrade material

Mix design and test results for Class J Concrete Base

Supplier and certified test results for granular material (coarse aggregate, foundation rock and pea gravel)

Mix design and test results for cement-stabilized backfill

Mix design and test results for controlled low strength material (CLSM)

Excavation Safety System Plan for proposed cofferdams, trench excavation and special shoring installations

401S.3 - Materials**A. Sand**

1. Fine aggregate sand shall be Grade 1 conforming to Standard Specification Item No. 302S, "Aggregates for Surface Treatments".
2. Native Sand shall be local material obtained from approved sources and subject to the approval of the Engineer or designated representative.

B. Flexible Base

Flexible base shall conform to the requirements of Standard Specification Item No. 210S, "Flexible Base".

C. Lime Stabilized Base

Lime stabilized base shall conform to the requirements of Standard Specification Item No. 202S, "Hydrated Lime and Lime Slurry" and Item No. 203S, "Lime Treatment for Materials in Place".

D. Concrete Base

Concrete base shall conform to a Class J Concrete as defined in Standard Specification Item No. 403S, "Concrete for Structures".

E. Granular Material

1. Coarse aggregate shall conform to the requirements of section 403S.3.C of Standard Specification Item No. 403S "Concrete for Structures".

2. Foundation Rock

Foundation rock shall be well graded, hard, durable coarse aggregate ranging in size from 2 to 6 inches (50 to 150 mm).

3. Pea Gravel

Pea gravel shall consist of hard, durable, opaque gravel, free of clay, loam, sand or other foreign substances, ranging in size from 1/4 inch to 3/8 inch (6.4 to 9.5 mm) conforming to ASTM C 33.

F. Cement Stabilized Backfill

Cement stabilized backfill shall contain aggregate, water and a minimum of 7% hydraulic cement based on the dry weight of the aggregate in accordance with TxDOT Test Method Tex-120-E, "Soil-Cement Testing. Unless directed otherwise on the Drawings, the aggregate shall be clean sand approved by the Engineer or designated representative.

G. Controlled Low Strength Material

Controlled low strength material (CLSM) shall conform to Standard Specification Item No. 402S, "Controlled Low Strength Material" and shall be approved by the Engineer or designated representative.

401S.4 - Construction Methods**A. Erosion Control and Tree Protection**

Prior to commencement of this work, all required erosion control and tree protection measures indicated on the Drawings shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Section 00700, "General Conditions" and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Areas within the construction limits indicated on the Drawings shall be cleared of all trees, stumps, brush, etc., except trees or shrubs scheduled for preservation which shall be carefully trimmed as directed by the Engineer or designated representative, in accordance with Standard Specification Item No. 610S, "Preservation of Trees and Other Vegetation" and shall be protected from scarring, barking or other injuries during construction operations. All exposed cuts over 2 inches (50

millimeters) in diameter, exposed ends of pruned limbs or scarred bark shall be treated with an approved asphalt material within 24 hours of the pruning or injury.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings and/or specified in the Contract Documents. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed.

Within the construction limits or areas indicated, all obstructions, stumps, roots, vegetation, abandoned structures, rubbish and objectionable material shall be removed to the following depths:

1. In areas to receive 6 inches (150 mm) or more embankment, a minimum of 12 inches (300 mm) below natural ground.
2. In areas to receive embankment less than 6 inches (150 mm), a minimum of 18 inches (450 mm) below the lower elevation of embankment, structure or excavation.
3. In areas to be excavated a minimum of 18 inches (450 mm) below the lower elevation of the embankment, structure or excavation.
4. In all other areas a minimum of 12 inches (300 mm) below natural ground.

When abandoned storm drains, sewers or other drainage systems are encountered they shall be removed as required to clear the new structure and plugged in a manner approved by the Engineer or designated representative.

Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc. shall be backfilled with select embankment material and compacted by approved methods. All cleared and grubbed material shall be disposed of in a manner satisfactory to the Engineer or designated representative. Unless otherwise provided, all materials as described above shall become the property of the Contractor and removed from the site and disposed of at a permitted disposal site.

Burning materials at the site shall conform to Standard Contract Document Section 01550, "Public Safety and Convenience".

B. Excavation

1. Excavation shall be done in accordance with the lines and depths indicated on the Drawings or as established by the Engineer or designated representative. Unless otherwise indicated on the Drawings or permitted by the Engineer or designated representative no excavation shall be made outside a vertical plane 3 feet (0.9 meter) from the footing lines and parallel thereto.

When structures are installed in streets, highways or other paved areas, the pavement and base shall be cut to neat lines. After completion of the excavation and backfilling, the pavement structure shall be restored to the satisfaction of the Engineer or designated representative.

2. Slopes, benching, sheeting, bracing, pumping and bailing shall be provided as necessary to maintain the stability and safety of excavations up to 5 feet (1.5 meters) deep. Excavation protection for excavations deeper than 5 feet (1.5 meters) shall be governed by Standard Specification Item No. 509S, "Excavation Safety Systems".
3. Excavation shall conform to elevations indicated on the Drawing or raised or lowered by written order of the Engineer or designated representative, when such alterations are judged proper. When it is deemed necessary to increase or decrease the plan depth of footings, the alterations in the details of the structure shall be as directed by the Engineer or designated representative. The Engineer or designated representative shall have the right to substitute revised details resulting from consideration of changes in the design conditions.
4. When a structure is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and the final excavation to grade shall not be

performed until just before the footing is placed. Equipment selected and used by the Contractor for excavation which results in disturbance of what was otherwise stable subgrade material, as shown by laboratory tests, will not be used as a justification for payment for excavating to extra depth or for payment for stabilizing materials which may be ordered by the Engineer or designated representative.

5. Excavated material required to be used for backfill may be deposited by the Contractor in storage piles as indicated on the Drawing or at points convenient for its rehandling during the backfilling operations, subject to the approval of the Engineer or designated representative, who may require that the survey center line of the structure and the transverse or hub line of any unit of the structure be kept free of any obstruction. The Contractor shall adjust any stockpiles, to facilitate surveying and the work of other Contractors working in the immediate proximity, as directed by the Engineer or designated representative.
6. Excavated material required to be wasted shall be disposed of as directed by the Engineer or designated representative, in a manner which will not obstruct the stream or otherwise impair the efficiency or appearance of the structure or other part of the work.
7. For all single and multiple box culverts, pipe culverts, pipe arch culverts and box sewers of all types, where the soil encountered at established footing grade is a quicksand, muck or similar unstable material, the following procedure shall be used unless other methods are indicated:
 - a) The depth to which unstable material is removed will be determined by the Engineer or designated representative. It will not exceed 2 feet (0.6 meter) below the footing of culverts that are 2 feet (0.6 meter) or more in height and will not exceed the height of culverts for those less than 2 feet (0.6 meter) high. Excavation shall be carried at least 1 foot (0.3 meter) horizontally beyond the limits of the structure on all sides. All unstable soil removed shall be replaced with suitable stable material, in uniform layers of suitable depth for compaction as directed by the Engineer or designated representative. Each layer shall be wetted, if necessary and compacted by rolling or tamping as required to provide a stable foundation for the structure. Soil, which has sufficient stability to properly sustain the adjacent sections of the roadway embankment, will be considered a suitable foundation material.
 - b) When, in the opinion of the Engineer or designated representative, it is not feasible to construct a stable footing as outlined above, the Contractor shall construct it by the use of special materials, such as flexible base, cement stabilized base, cement stabilized rockfill or other material, as directed by the Engineer or designated representative. This work will be paid for as provided in Section 401S.9, "Payment".
8. When the material encountered at footing grade of a culvert is found to be partially rock or incompressible material and partially a compressible soil which is satisfactory for the foundation, the incompressible material shall be removed for a depth of 6 inches (150 mm) below the footing grade and backfilled with a compressible material similar to that used for the rest of the structure.
9. When the material encountered at footing grade of a bridge bent or pier is found to be partially of rock or incompressible material, and partially of a compressible material, the foundation shall not be placed until the Engineer or designated representative has inspected the footing and authorized such changes found necessary to provide an adequate foundation.

401S.5 - Bridge Foundations and Retaining Walls

The material below the bottom of the footing grade shall not be disturbed. Backfill material shall not be used to compensate for excavation that is extended below the proposed footing grade. When excavation is carried below the proposed footing grade, the over excavated area shall be filled with concrete at the time the footing is placed. The additional concrete placement shall be at the Contractor's sole expense.

When required by the Engineer or designated representative, cores shall be taken to determine the character of the supporting material(s). The cores shall be taken when the excavation is nearing completion and shall be an intact sample adequate to judge the character of the founding material. The cores shall be acquired at a minimum depth of 5 feet (1.5 meters) below the proposed footing founding grade.

When the founding stratum is rock or other hard material, all loose material shall be removed and the founding grade cleaned and cut to a firm surface that is level, stepped or serrated as directed by the Engineer or designated representative. All soft seams shall be cleaned and filled with concrete at the time the footing is placed.

When the material at the footing grade of a retaining wall, bridge bent or pier is a mixture of compressible and incompressible material, the foundation shall not be placed until the Engineer or designated representative has inspected the excavation and authorized changes to provide a uniform bearing condition.

401S.6 - Cofferdams

The term cofferdams, whenever used in this specification, designates any temporary or removable structure constructed to hold the surrounding earth, water or both, out of the excavation, whether the structure is formed of earth, timber, steel, concrete or a combination of these. It includes earthen dikes, timber cribs, any type of sheet piling, removable steel shells and the like and all necessary bracing and it shall be understood also to include the use of pumping wells or well points for de-watering. The cost of cofferdams, when required, shall be included as a part of the bid price for excavation.

It is the intent of this specification to require that a suitable cofferdam be provided, when necessary, to insure that the foundation may be placed in a dry condition, as to preclude sliding and caving of the walls of the excavation. The cofferdam shall conform with the requirements of Standard Specification Item No. 509S, "Excavation Safety Systems" and shall provide a safe work area with sufficient clearance for the construction, inspection and removal of required forms and, if necessary, sufficient room to allow pumping outside the forms. Where no ground or surface water is encountered, the cofferdam need be sufficient only to protect the workers and to avoid cave-ins or slides beyond the excavation limits.

Unless otherwise indicated on the Drawings, cofferdams shall be removed by the Contractor after the completion of the substructure without disturbing or marring the structure.

401S.7 - De-Watering

Structures shall not be constructed or placed in the presence of water unless otherwise approved by the Engineer or designated representative. Precast members, pipe and concrete shall only be placed on a dry, firm surface. Water shall be removed by bailing, pumping, well-point installation, deep wells, underdrains or other approved method.

When structures are approved for placement in the presence of water, standing water shall be removed in a manner that shall preclude the possibility of the movement of water through or alongside any concrete being placed. Pumping or bailing will not be permitted during the placing of concrete or for a period of at least 36 hours thereafter, unless from a suitable sump separated from the concrete work by a water-tight wall.

Pumping or bailing during placement of seal concrete shall only be allowed to the extent necessary to maintain a static head of water within the cofferdam. De-watering inside a sealed cofferdam shall not commence until the seal has aged a minimum of 36 hours.

When the bottom of an excavation cannot be de-watered to the point that the subgrade is free of mud or it is difficult to keep the reinforcing steel clean a stabilizing material (e.g. flexible base, cement-stabilized-backfill or lean concrete) shall be placed in the bottom of the excavation. When a lean concrete is used,

the concrete shall include a minimum of 275 Pounds of cement per cubic yard (163 kilograms of cement per cubic meter) and be placed to a minimum depth of 3 inches (75 mm). Stabilizing material that is placed for the convenience of the Contractor will be at the Contractor's own expense.

401S.8 - Backfilling

A. General

As soon as practicable, all portions of excavation not occupied by the permanent structure shall be backfilled. Back-fill material shall be free from stones large enough to interfere with compaction, large or frozen lumps that will not break down readily under compaction, wood or other extraneous material. Backfill material shall be approved by the Engineer or designated representative.

That portion of backfill which will support any portion of completed roadbed, retaining wall or embankment shall be placed in layers not more than 8 inches (200 mm) in depth (loose measurement) and shall be compacted to meet the density requirements of the roadbed, retaining wall, embankment material, or as indicated on the Drawings.

That portion of backfill which will not support any portion of completed roadbed or embankment shall be placed in layers not more than 10 inches (250 mm) in depth (loose measurement) and shall be compacted to a minimum of 95 percent of maximum density as determined by TxDoT Test Method Tex-114-E and the re-excavated to the proper grade and dimensions.

If the excavation has been made through a hard material resistant to erosion, the backfill around piers and in front of abutments and wings may be ordered by the Engineer or designated representative to be of stone or lean concrete. Unless otherwise indicated on the Drawings, such backfill shall be paid for as extra work.

That portion of the backfill which will support any portion of the roadbed, retaining wall or embankment shall be placed in uniform layers not more than 8 inches (200 mm) in depth (loose measurement) and shall be compacted to a minimum of 95 percent of maximum density, as determined by TxDoT Test Method Tex-114-E and then re-excavated to the proper grade and wetted uniformly to the moisture content required to obtain the specified density and shall be compacted to that density by means of mechanical tampers or rammers, except that the use of rolling equipment of the type generally used in compaction embankments will be permitted on portions which are accessible to such equipment.

All portions of embankment too close to any portion of a structure to permit compaction by the use of the blading and rolling equipment used on adjoining sections of embankment, shall be placed and compacted with mechanical tamps and rammers to avoid damage to the structure.

These provisions require mechanical compaction by means of either rolling equipment or mechanical tampers or rammers, of all backfill and embankment adjoining the barrels and wingwalls or culverts and adjoining all sides of bridge abutments and retaining walls, regardless of whether or not such embankment or backfill is above or below the original surface of the ground and regardless of whether the excavation at structure site was performed conforming to Standard Specification Item No. 111S, "Excavation", this item 401S, "Structural Excavation", Standard Specification Item No. 110S, "Street Excavation" or Standard Specification Item No. 120S, "Channel Excavation". Unless otherwise indicated on the Drawings, hand tamping will not be accepted as an alternate for mechanical compaction.

As a general rule, material used in filling or backfilling the portions described in this paragraph shall be an earth, free of any appreciable amount of gravel or stone particles larger than 4 inches (100 mm) in greater dimension and of a gradation that permits thorough compaction. When, in the opinion of the Engineer or designated representative, such material is not readily available, the use of rock or gravel mixed with earth will be permitted, provided that no particles larger than 12 inches (300 mm) or smaller than 6 inches (150 mm) may be used. The percentage of fines shall be sufficient to fill all

voids and insure a uniform and thoroughly compacted mass of proper density. When required by the Drawings or by written order of the Engineer or designated representative, cement-stabilized-backfill material shall be used for backfilling.

All portions of fill and backfill described in the preceding paragraph shall be compacted to the same density requirements specified for the adjoining sections of embankment in accordance with the governing specifications. Where no embankment is involved on the project and no relevant specifications are included in the contract, all backfill shall be compacted to a density comparable with the adjacent undisturbed material.

No backfill shall be placed against any abutment or retaining wall until such structure has been in place at least 7 days. No backfill shall be placed adjacent to or over single and multiple boxes until the top slab has attained 500 psi (3450 kPa) flexural strength. Backfill placed around abutments and piers shall be deposited on both sides to approximately the same elevation at the same time.

Care shall be taken to prevent any wedging action of backfill against the structure and the slopes bounding the excavation shall be stepped or serrated to prevent such action. Backfill shall be uniformly placed around bridge foundations.

B. Pipe Culverts

The following requirements shall apply to the backfilling of pipe culverts in addition to the pertinent portions of the general requirements given in the preceding section.

Selected materials from excavation, borrow or other approved material shall be wetted, if required and placed along both sides of the pipe equally, in uniform layers not exceeding 8 inches (200 mm) in depth (loose measurement) and thoroughly compacted so that there shall be a berm of thoroughly compacted material on each side of the pipe. The method and degree of compaction shall be the same as specified above for portions of backfill within the limits of embankment or roadbed.

Filling and/or backfilling shall be continued in this manner to the elevation of the top of the pipe. Special care shall be taken to secure thorough compaction of the material placed under the haunches of the pipe to prevent damage or displacement of the pipe. All fill or backfill below the top of pipe shall be compacted mechanically in the manner and to the density prescribed above, regardless of whether or not such material is placed within the limits of the embankment or roadbed. In the case of pipe placed in trenches, that portion of the backfill above the top of the pipe which supports embankment or the roadbed shall receive mechanical compaction as specified above and the portion which will not support any portion of embankment or roadbed shall be placed in layers not more than 8 inches (200 mm) in depth (loose measurement) and shall be compacted by whatever means the Contractor chooses, to a density comparable with the adjacent, undisturbed material. Embankments above the top of pipe shall be placed conforming to Item No. 132S, "Embankment". During construction adequate cover must be provided to protect the structure from damage.

The Engineer or designated representative may reject backfill material that contains more than 20% by weight of material retained on a 3-in (75 mm) sieve, with large lumps not easily broken down, or that cannot be spread in loose layers. Material excavated by a trenching machine will generally meet the requirements of this Section as long as large stones are not present.

Where pipe extends beyond the toe of slope of the embankment and the depth of cover provided by backfill to the original ground level is less than the minimum required by the specifications for the type of pipe involved, additional material shall be placed and compacted until the minimum cover has been provided.

Whenever excavation is made for installing pipe culverts or box sewers across private property or beyond the limits of the embankment, the top soil removed in excavating the trench shall be kept separate and replaced as nearly as feasible in its original position and the entire area involved in the construction operations shall be restored to a presentable condition.

C. Cement Stabilized Backfill

When indicated on the Drawings, trenches shall be backfilled to the elevations shown with cement stabilized backfill. The cement-stabilized backfill shall be placed equally along the sides of structures to prevent strain on or displacement of the structure.

Cement stabilized backfill below the spring line of pipe culverts shall be sufficiently plastic to completely fill all voids in the trench. Hand operated tampers may be used if necessary to fill the voids. The pipe shall be held in alignment by jacks or other suitable means to prevent the mortared joints from cracking due to displacement caused by placing the backfill material.

Cement stabilized backfill above the spring line of pipe culverts may be dry enough to be transported without special mixing equipment.

On structures other than pipe culverts, special mixing equipment will not be required to transport the cement stabilized backfill unless otherwise indicated on the Drawings.

D. Controlled Low Strength Material (CLSM)

When indicated on the Drawings the excavation shall be backfilled with CLSM to the elevations shown. The structure shall be prevented from being displaced or "floated out" during the placement of CLSM. The CLSM shall be prevented from entering culverts and drainage structures.

401S.9 - Measurement

Unless otherwise indicated on the Drawings, structural excavation for pipe headwalls, inlets, manholes, culvert widening (extensions), bridge abutments and side road and private entrance pipe culverts will not be measured in the field but shall be included in the Plan Quantity unit price bid by the cubic yard (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) Determination of plan quantities for structural excavation shall be made by the method of average end-areas using the following limits to establish templates for measurement.

- A. For all structures requiring measurement, except the barrels of pipe culverts, no material outside of vertical planes 1 foot (300 mm) beyond the edges of the footings and parallel thereto will be included.
- B. For the barrels of pipe culverts of 42 inches (1.09 meters) or less nominal or equivalent diameter, no material outside of vertical planes 1 foot (300 mm) beyond the horizontal projection of the outside surfaces of the pipe and parallel thereto will be included. For the barrels of pipe culverts more than 42 inches (1.09 meters) in nominal or equivalent diameter, no material outside of vertical planes located 2 feet (600 mm) beyond the horizontal projection of the outside surfaces of the pipe and parallel thereto will be included.
- C. If a cofferdam, as herein defined, is used, the limitations indicated above shall apply just as if no cofferdams were used.
- D. Where excavation in addition to that allowed for the footings is required for other portions of the structure, such as for the cap, cross strut or tie beam of a pier or bent or for the superstructure, measurements for such additional excavation will be limited laterally by vertical planes 1 foot (300 mm) beyond the face of the member and parallel thereto and vertically to a depth of 1 foot (300 mm) below the bottom of such member.
- E. Except as allowed by the above conditions, no account will be taken of any excavation necessary for placing forms or falsework.
- F. Except at side road culverts, all street excavation called for on the contract drawings at all structure sites shall be assumed to be completed before starting the structural excavation and the measurement of structural excavation will include only material below or outside the limits of the

completed street excavation. Excavation for side road and private entrance pipe culverts will not be measured for payment but shall be included in the unit price bid for this specification item.

- G. On all structures of bridge classification where the contract drawings call for channel excavation at the structure site, it shall be assumed to have been completed before starting the structural excavation and the measurement of structural excavation will include only material below or outside the limits of the completed channel section. The method of measurement for payment will be in accordance with this procedure regardless of the actual construction methods followed.
- H. Where excavation diagrams are indicated on the Drawings, they shall take precedence over these provisions.
- I. Measurement will not include materials removed below footing grades to compensate for anticipated swellage due to pile driving and it will not include material required to be removed due to swellage beyond the specified limits during pile driving operations.
- J. Measurement will not include additional yardage caused by slips, slides, cave-ins, siltings or fillings due to the action of the elements or the carelessness of the Contractor. Water will not be classed as excavated material.
- K. Where rock, other incompressible or unstable material is undercut to provide suitable foundation for pipe or box culverts, such material below grade, ordered by the Engineer or designated representative to be removed, will be measured for payment.
- L. Except for any required undercut, quantities for "Structural Excavation", as indicated on the Drawings, shall be considered as final quantities and no further measurement will be required, unless the alignment, grades or structure locations are revised by the Engineer or designated representative during construction. Final determination of quantities for individual structures will be made, if in the opinion of the Engineer or designated representative or upon evidence furnished by the Contractor, substantial variations exist between quantities indicated on the Drawings and actual quantities due to changes in cross sections or apparent errors. Excavation quantities for foundations indicated on the Drawings where cofferdams are required shall be considered as final quantities and no further measurement will be made.
- M. For any footing, foundation or other structure unit within the scope of this specification, additional measurement will be made of the volume of excavation involved in the lowering or raising of the elevation of a footing, foundation or structure unit, when such grade change is authorized by the Engineer or designated representative. Measurement will be made by the addition to or the deduction from, the original quantities for the volume of excavation involved in the authorized grade change.
- N. Cement stabilized backfill shall be measured by the backfill diagram as indicated on the Drawings. The quantity of "Cement Stabilized Backfill" as indicated on the Drawings shall be considered as final quantities and no further measurement will be required, unless alignment or grade elevations as indicated are revised by the Engineer or designated representative. If such revisions result in an increase or decrease in this quantity, the final quantity will be revised by the amount represented by the changes in alignment or grade elevations.

401S.10 - Payment

Payment for all work prescribed under this item and measured as provided above will be made at the unit bid price per cubic yard for the particular class of excavation specified on the Drawings in the amount shown on the Drawings and in the proposal. Payment for revised quantities will be made as specified above and for the removal of unstable and incompressible material as noted below.

Payment for removal and replacement of unstable or incompressible material below the footing grades of culverts and box sewers as indicated above will be made as follows:

When indicated on the Drawings or the Engineer or designated representative directs the use of special materials such as flexible base, concretebase, cement stabilized backfill, controlled low strength material

or other special material, payment for excavation below the footing grades shall be made at the unit bid price for "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation", as the case may be. Payment for furnishing, hauling, placing and compacting the flexible base, concrete base, cement stabilized backfill, controlled low strength material or other special material will be made at the unit bid price for these items in the bid or in accordance with pertinent provisions for extra work.

Where special materials are not required or specified, the removal and replacement of the unstable material will be performed as described above. Payment therefore will be made at a price equal to 200 percent of the unit bid price per cubic yard for "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation", as the case may be. The unit bid price shall include full compensation for removing the unstable or incompressible material, for furnishing, hauling, placing and compacting suitable material required to replace it and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment for "Concrete Base", "Cement Stabilized Backfill" and "Controlled Low Strength Material" measured as prescribed above shall be made at the unit bid price per cubic yard. The unit bid price shall include full compensation for furnishing all materials, tools, labor, equipment, sheathing and incidentals required to perform the applicable work prescribed herein.

When the Engineer or designated representative judges it necessary to lower the structure footings to an elevation below the grade indicated on the Drawings, payment for the "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation" as the case may be, required below plan grade down to and including an elevation 5 feet (1.525 meters) below drawing grade for any individual footing will be made at a unit price equal to 115 percent of the contract unit bid price. Payment for the excavation from an elevation over 5 feet (1.525 meters) below plan grade down to and including an elevation 10 feet (3.05 meters) below plan grade will be made at a unit price equal to 125 percent of the contract unit bid price for "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation" as the case may be. No increase in unit price will be allowed for other bid items of the contract and no additional compensation will be allowed for any required cofferdam adjustments made necessary by such lowering of footings. These provisions shall not apply to the lowering of culverts, except when the flow line grade is lowered 1 foot (300 mm) or more below plan grade.

In cases where the extra depths required for any footing or footings exceeds 10 feet (3.05 meters), a supplemental agreement shall be made covering the quantities removed from depths in excess of 10 feet (3.05 meters) below plan grade.

No direct payment will be made for filling or backfilling around structures. Payment for the backfilling and compacting of areas, which were removed as structural excavation shall be included in the unit bid prices for the various classes of structural excavation.

At the end of each estimate period, the Engineer or designated representative shall determine the completed portion of the total work under Standard Specification Item No. 401S "Structural Excavation and Backfill" and payment shall be made accordingly.

Filling or backfilling of areas above the natural ground level or above the limits of street excavation or channel excavation sections shall be considered as Standard Specification Item No. 132S, "Embankment" and payment therefore shall be included in the unit prices bid for the various classes of Standard Specification Item No. 110S, "Street Excavation", Standard Specification Item No. 120S, "Channel Excavation" or Standard Specification Item No. 130S, "Borrow".

Where no channel excavation is provided for at culvert sites and where it is necessary to excavate beyond the limits of structural excavation, as herein described in order that the culvert may function properly, such excavation shall be included with structural excavation as may be indicated on the Drawings.

Payment for all work prescribed under this item shall include full compensation for all excavation and backfill including compaction, all soundings, construction of all cofferdams, all dewatering and for furnishing all materials, labor, equipment, tools, sheathing, bracing, cofferdams, pumps, drills, explosives and incidentals necessary to complete the work, except for specific allowances stated above.

Special materials used or additional excavation made for the Contractor's convenience to expedite the work will not be paid for directly, but shall be included in the unit price bid for this specification item. In addition, if the Contractor's construction methods and equipment creates conditions necessitating usage of special materials or additional excavation, the work and materials will not be paid for directly, but shall be included in the unit price bid for this specification item.

When specified in the contract bid form as a separate pay item(s), the item(s) will be paid for at the contract unit price(s) for "Flexible Base", "Lime Stabilized Base" and "Controlled Low Strength Material". The bid prices shall include full compensation for all Work herein, specified, including the disposal of all material not required in the Work, the furnishing of all material, equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under one of the following:

Pay Item No. 401S-A:	Unclassified Structural Excavation, Plan Quantity	Per Cubic Yard.
Pay Item No. 401S-B:	Common Structural Excavation	Per Cubic Yard.
Pay Item No. 401S-C:	Rock Structural Excavation	Per Cubic Yard.
Pay Item No. 401S-D:	Concrete Base	Per Cubic Yard.
Pay Item No. 401S-E:	Cement Stabilized Backfill	Per Cubic Yard.
Pay Item No. 401S-F:	Flexible Base	Per Cubic Yard.
Pay Item No. 401S-G:	Lime Stabilized Base	Per Square Yard.
Pay Item No. 401S-H:	Controlled Low Strength Material	Per Cubic Yard.
Pay Item No. 401S-I:	Cofferdams, type	Per Cubic Yard.
Pay Item No. 401S-J:	Dewatering	Per Cubic Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>
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<u>Standard Specification Item 401S, "Structural Excavation and Backfill"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
Section 00700	General Conditions
Section 01550	Public Safety and Convenience
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 5.2.0	Permit Information and Format
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 130S	Borrow
Item No.	Embankments

132S	
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 210S	Flexible Base
Item No. 302S	Aggregates for Surface Treatments
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
Item No. 509S	Excavation Safety Systems
Item No. 610S	Preservation of Trees and Other Vegetation

Texas Department of Transportation: Departmental Material Specifications

<u>Designation</u>	<u>Description</u>
DMS-4640	Chemical Admixtures for Concrete

American Society for Testing and Materials, ASTM

<u>Designation</u>	<u>Description</u>
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ASTM C 33	Specification For Concrete Aggregates
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-114-E	Laboratory Compaction Characteristics & Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-120-E	Soil-Cement Testing

RELATED CROSS REFERENCE MATERIALSStandard Specification Item 401S, "Structural Excavation and Backfill"Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item 110	Excavation
Item 132	Embankment
Item 400	Excavation and Backfill for Structures
Item 401	Flowable Backfill
Item 402	Trench Excavation Protection
Item 403	Temporary Special Shoring
Item 421	Hydraulic Cement Concrete

ITEM NO. 408S - CONCRETE JOINT MATERIALS 11-13-07

408S.1 - Description

This item shall govern the furnishing and placing of all longitudinal, transverse contraction and expansion joint material in concrete work as herein specified in the various items of these specifications as indicated or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

408S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer of all joint materials proposed for use.
- B. Technical data indicating that proposed products meet the requirements specified herein.

408S.3 - Materials

(1) Preformed Asphalt Board

Preformed asphalt board formed from cane or other suitable fibers of a cellular nature securely bound together and uniformly impregnated with a suitable asphaltic binder and meeting the requirements of the Standard Specifications for Preformed Expansion Joint Filler for Concrete (Bituminous Type), ASTM D 994.

(2) Preformed Nonbituminous Fiber Material

Preformed nonbituminous fiber material shall meet the requirements of the Standard Specifications for the Preformed Expansion Joint Filler for Concrete Paving and Structural Construction, ASTM D 1751, except that the requirements pertaining to bitumen content, density and water absorption shall be voided.

(3) Boards

Boards obtained from Redwood timber, of sound heartwood, free from sapwood, knots, clustered birdseye, checks and splits. Occasional sound or hollow birdseye, when not in clusters, will be permitted provided the board is free from any other defects that will impair its usefulness as a joint filler.

(4) Joint Sealer (Concrete Pavement)

This material shall be a one part low modulus silicone especially designed to cure at ambient temperatures by reacting with moisture in the air and shall have the following properties:

As Supplied	
Color	Gray
Flow, MIL-2-8802D Sec. 4.8.4	0.2 maximum

Working Time, minutes	10Tack-Free Time at 77°F 2F (25°C 1.66°C) Min.
MIL-2-8802D Sec.4.8.7	60
Cure time, at 77°F (25°C), days	7-14
Full Adhesion, days	14-21
As Cured—after 7 days at 77°F (25°C) and 40% RH	
Elongation, percent minimum	1200
Durometer Hardness, Shore A, points ASTM 2240	15
Joint Movement Capability, percent	+100/-50
Tensile Strength, maximum elongation,psi (kPa)	100 (689)
Peel Strength, psi (kPa)	25 (172)

The joint sealer shall adhere to the sides of the concrete joint or crack and shall be an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperature.

(5) Backer Rod

Backer Rod shall be expanded closed cell polyethylene foam compatible with sealant. No bond or reaction shall occur between rod and sealant. Backer Rod shall be of sufficient width to be in compression after placement and shall be used with joint sealer.

(6) Joint Sealing Material

Joint Sealing Material for other than pavement use may be a two-component, synthetic polymer or cold-pourable, self leveling type meeting the following requirements:

The material shall adhere to the sides of the concrete joint or crack and shall form an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperatures. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles. It shall cure sufficiently at an average temperature of 77°F 3°F (25°C 1.66°C) so as not to pick up under wheels of traffic in a maximum of 3 hours.

Performance Requirements:

When tested in accordance with Test Method Tex-525-C, the joint sealing material shall meet the above curing times and the requirements as follows:

It shall be of such consistency that it can be mixed and poured or mixed and extruded into joints at temperatures above 60°F (1.66°C).

Penetration 77°F (25°C), 150 gm. Cone, 5 sec., max.-cm	0.90
Bond and Extension 75%, OF, 5 cycles:	
Dry Concrete Blocks	Pass
Wet Concrete Blocks	Pass
Steel Blocks (Primed if specified by manufacturer)	Pass
Flow at 200 °F (93°C)	None
Water content % by weight, max.	5.0
Resilience:	
Original sample min. % (cured)	50
Oven-aged at 158°F (70°C) min. %	50
For Class 1-a material only, Cold Flow (10 minute)	None

(7) Rebonded Recycled Tire Rubber

This material consists of granular particles of rubber, made by grinding automobile and truck tires, securely bound together by a synthetic resin or plastic binder. The filler must be molded into sheets of the required dimensions, which meet the testing requirements of both ASTM D 1751 and ASTM D 1752, except that the requirements for asphalt content and expansion are waived. The density of the material must be at least 30 lb/ft³ (440kg/m³).

408S.4 - Construction Methods

The Contractor shall install "Concrete Joint Materials" which will function as a compatible system. Joint sealer shall not be placed where a bond breaker is present.

Asphalt, Redwood board or other materials used shall extend the full depth of the concrete and shall be perpendicular to the exposed face. All joints shall be shaped to conform to the contour of the finished section in which they are installed. All material shall be a minimum of ½ inch (12.5 mm) thick or as indicated. Wood materials shall be anchored to the adjacent concrete to permanently hold them in place. Joint sealer shall be installed in accordance with the manufacturer's recommendations.

The material used for side walk expansion joints shall conform to No. 3 above, unless otherwise indicated.

The material used for curb and gutter expansion joints filler shall conform to any of the above, except when placed adjacent to concrete pavement, the joint material shall match the pavement joint material.

408S.5 - Measurement and Payment

No additional compensation will be made for materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 408S, " Concrete Joint Materials"</u>	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
D 994	Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
D 1751	Specification for Preformed Expansion Joint Filler for Concrete
	Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D 1752	Specification for Preformed Sponge Rubber and Cork Expansion
	Joint Fillers for Concrete Paving and Structural Construction
D 2240	Standard Test Method for Rubber Property-Durameter Hardness
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-525-C	Tests for Asphalt and Concrete Joint Sealers

ITEM NO. 409S - MEMBRANE CURING 11-13-07**409S.1 - Description**

This item shall govern curing concrete pavement, concrete base, pavement, curbs, gutters, retards, sidewalks, driveways, medians, islands, concrete riprap, cement stabilized riprap, concrete structures and other concrete as indicated by applying an impervious liquid membrane forming material.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

409S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer for all membrane curing materials proposed.
- B. Proposed curing procedures.

409S.3 - Material

The liquid forming membrane curing compound shall comply with the "Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete", ASTM C 309, Type 1-D clear or translucent, with fugitive dye or Type 2 white pigmented. The material shall have a minimum flash point of 80°F (26.7°C) when tested by the "Pensky-Martin Closed Cup Tester", ASTM D 93.

It shall be of such consistency that it can be satisfactorily applied as a fine mist through an atomizing nozzle by means of approved pressure spraying equipment at atmospheric temperatures above 40°F (4.4°C).

It shall be of such nature that it will not produce permanent discoloration of concrete surfaces nor react deleteriously with the concrete or its components. Type 1 compound shall contain a fugitive dye that will be distinctly visible not less than 4 hours nor more than 7 days after application.

Type 2 compound shall not settle out excessively or cake in the container and shall be capable of being mixed to a uniform consistency by moderate stirring and shall exhibit a daylight reflectance of not less than 60 percent of that of magnesium oxide when tested as indicated.

The compound shall produce a firm, continuous, uniform moisture impermeable film, free from pinholes and shall adhere satisfactorily to the surfaces of damp concrete. When applied to the damp concrete surface at the rate of coverage indicated, the compound shall dry to the touch in not more than 4 hours and shall not be tacky or track off concrete after 12 hours.

It shall adhere to horizontal and vertical surfaces in a tenacious film and shall not run off or show an appreciable sag, disintegrate, check, peel or crack during the required curing period.

Under traffic, the compound shall not pick up or peel and shall gradually disintegrate from the surface.

The compound shall be delivered to the job only in the manufacturer's original containers, which shall be clearly labeled with the manufacturer's name, the trade name of the material and a batch number or symbol with which test samples may be correlated.

The water retention test shall be in accordance with the following:

Percentage loss shall be defined as the water lost after the application of the curing material was applied. The permissible percentage moisture loss (at the rate of coverage specified herein) shall not exceed the following:

24 hours after application	2 percent
72 hours after application	4 percent

409S.4 - Measurement and Payment

The membrane curing compound shall be applied after the surface finishing has been completed and immediately after the free surface moisture has disappeared. The surface shall be sealed with a single uniform coating of the specified type of curing compound applied at the rate of coverage recommended by the manufacturer and directed by the Engineer or designated representative, but not less than 1 gallon per 180 square feet (3.8 liters per 16.7 square meters) of area. The Contractor shall provide satisfactory means and facilities to properly control and check the rate of application of the compound.

The compounds shall not be applied before the surface has become dry, but shall be applied just after free moisture has disappeared.

The compound shall be thoroughly agitated during its use and shall be applied by means of approved mechanical power pressure sprayers for street and bridge applications. The sprayers used to apply the membrane to concrete exposed surfaces shall travel at a uniform speed along the forms and be mechanically driven. The equipment shall be of such design that it will insure uniform and even application of the membrane material. The sprayers shall be equipped with satisfactory atomizing nozzles. On small miscellaneous items or on interim bridge deck curing will the Contractor be permitted to use hand-powered spray equipment. For all spraying equipment, the Contractor shall provide facilities to prevent the loss of the compound between the nozzle and the concrete surface during the spraying operations.

At locations where the coating shows discontinuities, pinholes or other defects or if rain falls on the newly coated surface before the film has dried sufficiently to resist damage, an additional coat of the compound shall be applied immediately at the same rate of coverage specified herein.

To insure proper coverage, the Engineer or designated representative shall inspect all treated areas after application of the compound for the period of time designated in the specification for curing, either for membrane curing or for other methods. Dry areas are identifiable because of the lighter color of dry concrete as compared to damp concrete. All suspected areas shall be tested by placing a few drops of water on the suspected areas. If the water stands in rounded beads or small pools which can be blown along the surface of the concrete without wetting the surface, the water impervious film is present. If the water wets the surface of the concrete as determined by obvious darkening of the surface or by visible soaking into the surface, no water-impervious film is present. Should the foregoing test indicate that any area during the curing period is not protected by the required water-impervious film an additional coat or coats of the compound shall be applied immediately and the rate of application of the membrane compound shall be increased until all areas are uniformly covered by the required water-impervious film.

The compounds shall not be applied to a dry surface and if the surface of the concrete has become dry, it shall be thoroughly moistened prior to the application of the membrane by fogging or mist application. Sprinkling or coarse spraying will not be allowed.

When temperatures are such as to warrant protection against freezing, curing by this method shall be supplemented with an approved insulating material capable of protecting the concrete for the specified curing period.

If at any time there is reason to believe that this method of curing is unsatisfactory or is detrimental to the work, the Contractor, when notified, shall immediately cease the use of this method and shall change to curing by one of the other methods specified under this contract.

Curing compounds shall be compatible with the adhesion of toppings or overlays where curing has been applied to the concrete base surface in order to assure adequate bond.

When forms are stripped before the 4 minimum curing days have passed, curing shall continue by an approved method.

409S.5 - Measurement and Payment

Membrane curing will not be measured for payment. The work and materials prescribed herein will not be paid for directly, but shall be included in the unit price bid for the item of construction in which these materials are used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 409S, "Membrane Curing"</u>	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
C 309	Liquid Membrane-forming Compounds for Curing Concrete
D 93	Pensky-Martin Closed Cup Tester

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 409S, "Membrane Curing"</u>	
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 360	Concrete Pavement
Item 420	Concrete Structures

Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

ITEM NO. 411S - SURFACE FINISHES FOR CONCRETE 11-13-07**411S.1 - Description**

This item shall govern the furnishing of all materials and the application by the methods of construction indicated on the Drawings for the application of a surface finish to concrete.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

411S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer of cement(s).
- B. Type and manufacturer of membrane curing compound.
- C. Type and manufacturer of adhesive grout.
- D. Type and manufacturer of resin paint.
- E. Samples as requested.
- F. Locations of proposed grade/class of finishes.

411S.3 - Materials**(1) Masonry Sand**

Masonry sand shall conform to ASTM C 144.

(2) White Cement

White cement shall conform to ASTM C 150.

(3) Portland Cement

All cement unless otherwise indicated shall be Portland cement conforming to ASTM C 150.

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

(4) Membrane Curing

Membrane curing shall conform to Item No. 409S, "Membrane Curing".

(5) Adhesive Grout

This subsection sets forth the requirements for three epoxy adhesives with different viscosities designed to bond fresh Portland Cement concrete to existing Portland

Cement concrete, hardened concrete to hardened concrete and steel to fresh or hardened concrete. These adhesives are as follows:

Type V: Standard (medium viscosity) for applying to horizontal and vertical surfaces. This material is suitable for surface sealing of fine cracks in concrete.

Type VI: Low viscosity for application with spray equipment to horizontal surfaces.

Type VII: Paste consistency for overhead application and where a high buildup is required. This material is suitable for surface sealing of cracks in concrete, which are veed out prior to sealing, and for grouting of dowel bars where clearance is 1/16 inch (1.6 mm) or less.

- (a) **Mixing Ratio:** The ratio of resin and hardener components to be mixed together to form the finished adhesive shall be either 1 to 1 or 2 to 1 by volume.

Any specific coloring of resin and/or hardener components desired will be stated by the Engineer or designated representative.

Fillers, pigments and thixotropic agents. All fillers, pigments and/or thixotropic agents in either the epoxy resin or hardener component must be of sufficiently fine particle size and dispersed so that no appreciable separation or settling will occur during storage.

Any fillers present in the low viscosity version must be of such a nature that they will not interfere with application by spray equipment or abrade or damage such equipment.

The concrete adhesive shall contain no volatile solvents.

- (b) **Consistency:** The adhesives shall comply with the following:

	Type V	Type VI	Type VII
Viscosity of mixed adhesive 77° ± 1°F, (25° ± -17°C) Poises	400 Maximum	150 Maximum	must be sufficiently fluid to apply by trowel or spatula without difficulty
Pot Life at 77°F (25°C), minutes minimum - 30			
Set Time at 77°F (25°C) (Time required to attain 180 psi (1.3 mPa)), hours maximum - 12			

Thixotropy test shall be performed at both 77° and 120°F (25° and 49°C). Average thickness of cured adhesive remaining on test panel, mils minimum.

Type V	Type VII
30	45

Samples of the individual components in sealed containers shall be maintained at 115° + 3°F (46° + -16°C) for 2 weeks. The mixed adhesive prepared from these samples must still comply with the minimum thixotropy requirements.

The viscosity of the Type V and Type VI versions must not show an increase of more than 20 percent compared with the viscosity prior to the stability test. The Type VII adhesive must still be sufficiently fluid to apply by trowel or spatula without difficulty.

(c) Physical Properties of the Cured Adhesive

Property	Requirements
Adhesive Shear Strength, psi (mPa), minimum	2200 (15)
Water Gain, percent by weight (mass), maximum	0.20
Ability to bond fresh Portland cement concrete to cured Portland cement concrete psi (mPa), minimum (7 days cure time)	400 (2.8)

(6) Synthetic Resin Paint

Type X Epoxy: This is a high solids epoxy coating designed for application by brush or roller. The materials can also be applied by airless spray by addition of a maximum of 5 percent toluene solvent at the direction of the Engineer or designated representative.

Raw Materials: The basic raw materials to be incorporated into this coating are listed below, along with the specific requirements for each material. The final decision as to the quality of materials shall be made by the Engineer or designated representative. After the Engineer or designated representative has approved the brand names of raw materials proposed by the Contractor, no substitution will be allowed during the manufacture without prior approval of the Engineer or designated representative.

Epoxy Resin: The basic epoxy resin used in the formulation shall be an unmodified liquid resin conforming to the following chemical and physical requirements:

Viscosity at 25.0 ± 0.1 C, cps	7,000 to 10,000
Weight per epoxy equivalent, gms per gm - mole	175 to 195
Color (Gardner Number), maximum	5
Hydrolyzable chlorine, maximum % by weight	0.2
Specific gravity, 25/25 degrees	1.14 to 1.18

Test methods to be used in determining these qualities are listed below:

- (a) Viscosity - Test for Kinematic Viscosity (ASTM Designation: D 445).
- (b) Weight per Epoxy Equivalent - Test for Epoxy Content of Epoxy Resins (ASTM Designation: D 1652).

- (c) Color - Test for Color of Transparent Liquids (Gardner Color Scale) (ASTM Designation: D 1544).
- (d) Hydrolyzable Chlorine - Test for Hydrolyzable Chlorine Content of Liquid Epoxy Resins (ASTM Designation D: 1726).
- (e) Specific Gravity - Method of Test for Density of Paint, Varnish, Lacquer and Related Products (ASTM Designation: D 1475).

Pigment

Titanium Dioxide: The titanium dioxide used in this formulation shall be equivalent to DuPont R-900. This shall be a pure, chalk-resistant, rutile titanium dioxide meeting the requirements of ASTM D 476, Type III.

Extender: The extender used in this formulation shall be Nyad 400, manufactured by Interpace Pigments. Specific requirements are as follows:

Particle size distribution	Minimum	Maximum
Minus 20 microns, percent by weight	95	
Minus 10 microns, percent by weight	70	80
Minus 5 microns, percent by weight	40	50
Minus 3 microns, percent by weight	30	40
Minus 1 micron, percent by weight	14	20
Oil Absorption (rub out, lbs/100 lbs)		25 maximum
Brightness (G.E.)	92.5 minimum	

411S.4 - Grade of Finish

(1) General

The grade and/or class of finish shall be as described herein and as indicated.

"Grade" of finish designates the areas to which a higher finish is to be applied beyond the requirements of an Ordinary Surface Finish. Four grades of finish are included herein.

"Class" of finish designates the materials or the process to be used in providing the grade of finish. Three classes of finish are included herein.

For structures and surfaces not described herein under grade of finish, a class of finish only may be indicated. Where neither a grade nor class is specified, an Ordinary Surface Finish only will be required as specified in Item No. 410S, "Concrete Structures".

Where the plans specify a grade and class of finish, i.e., Grade II, Class C, only that type of finish shall be furnished.

Where the plans specify a grade of finish only, i.e., Grade I Finish, any of the classes of finish may be furnished. Only one class of finish shall be furnished on any individual structure, twin structures or on structures in close proximity to each other, except as specified for prestressed concrete members below.

(2) Grade I

The following areas shall receive a Class A, B or C (two rub) Finish, except that prestressed members shall receive either a Class A or B Finish only.

All concrete surfaces of railing, including the parapet types; exterior vertical faces of slabs, slab spans, arches and box girders; the outside and bottom surfaces of fascia beams or girders (including prestressed members); the underside of overhanging slabs to the point of juncture of the supporting beam; all exposed vertical surfaces of bents and piers and bottom surfaces of bent caps; all exposed surfaces of tie beams, abutments, bridge wingwalls, culvert headwalls and wingwalls and retaining walls exposed to view after all backfill and is placed.

Unless otherwise indicated, the underside of the slab of slab spans shall be finished its entire width.

Unless otherwise indicated, exposed surfaces of pump houses and other miscellaneous concrete surfaces shall receive a Class A, B or C (one rub) Finish.

(3) Grade II

All concrete surfaces of railing, including the parapet types, all exposed surfaces of bridge wingwalls and the exterior vertical faces of slabs and slab spans shall receive a Class A, B or C (two rub) Finish. All other surfaces described under Grade I Finish shall receive a Class A or B finish only. The underside of slab spans shall receive an Ordinary Surface Finish only.

(4) Grade III

All concrete surfaces of railing, including the parapet types, all exposed surfaces of bridge wingwalls and the exterior vertical faces of slabs shall receive a Class A, B or C (two rub) Finish. All other surfaces described under Grade I Finish shall receive an Ordinary Surface Finish.

(5) Grade IV

The top and roadway faces only of all concrete railing, including the parapet types and bridge wingwalls shall receive a Class A, B or C (one rub) Finish. All other surfaces described under Grade I shall receive an Ordinary Surface Finish.

411S.5 - Class of Finish

The Class of Finish designates either an adhesive grout material, a paint-type material or a rubbing process applied to surfaces specified in "Grade of Finish", as required above and/or as indicated.

Unless otherwise indicated the color shall be concrete gray.

(1) Class A

This finish shall consist of an adhesive grout textured coating with a minimum 1/16 inch thickness, composed of 1 part white cement, 1 part natural (gray) cement, 2 parts masonry sand, 1 part (latex)

emulsion and enough water to form a viscous slurry of a consistency that may be applied by spray gun, brush or roller without appreciable running or sagging. The proportions of white and gray cement may be varied slightly to obtain the desired color.

Gradation of the masonry sand shall be as required to produce a texture satisfactory to the Engineer or designated representative.

Prepackaged materials meeting these requirements and acceptable to the Engineer or designated representative as to color, texture and appearance will be permitted.

(2) Class B

The finish shall be a paint-type material, consisting of a synthetic resin, containing fibrous as well as texturing pigments, which when applied by a 1 coat spray application at the rate of 45 ± 5 square feet per gallon (15.9 ± 1.9 square meters per liter) yield an acceptable textured coating. Certification by the manufacturer of the above materials will be required.

(3) Class C

This finish shall consist of a one rub or two rub system, as the case may be, meeting the requirements set forth below under "Construction Methods".

411S.6 - Approval of Surface Finishing Materials

The material to be furnished shall meet the requirements of TxDOT Specification DMS-8110, Structural Coatings, latest revision.

In addition to the above, the manufacturer shall furnish the following:

- (1) At the time of original request for approval of the surface furnishing material, the manufacturer shall supply a 1-gallon (3.8 L) sample of the material to the Engineer or designated representative, if requested.
- (2) Each 6 months after approval of the material, the manufacturer shall furnish a notarized certification indicating that the material originally approved has not been changed or altered in any way. Any change in formulation of a surface finish shall require retesting prior to use.

The Engineer or designated representative may request additional information to be submitted such as infrared spectrophotometry scan, solids content, etc., for further identification. A change in formula discovered by any of the tests prescribed herein or by other means and not reported and retested, may be cause to permanently bar the manufacturer from furnishing surface finish materials for City work.

The City reserves the right to perform any or all of the tests required by this specification as a check on the tests reported by the manufacturer. In case of any variance the City tests will govern.

411S.7 - Construction Methods

Prior to application of any of the finishes required herein, concrete surfaces shall be given an Ordinary Surface Finish. For Class A and B materials, concrete surfaces shall be clean and free of dirt, grease, curing compound or any other bond breaking substance. Class A shall be applied on moistened surfaces but Class B requires a dry surface. The temperature of the atmosphere, concrete and compound shall be above 50°F (10°C) for Classes A and B at the time of application. The finished surfaces shall be protected against rain or freezing for a period of 24 hours after application.

Class A materials shall be applied by spraying, by roller or by brush. Class B materials shall be applied by spraying only. All applications shall provide an acceptable texture of the proper coverage.

The Class A and B material shall be applied after all preparation work required by Ordinary Surface Finish has been completed.

The Class C Finish shall be performed with a carborundum stone as follows, after all preparatory work required by Ordinary Surface Finish has been completed:

For a two-rub system, the first rubbing shall bring the wetted concrete face to a paste and produce a smooth dense surface without pits, form marks or other irregularities. The use of cement or grout to form the paste will not be permitted. Striping with a brush and washing after the first rubbing will not be required. Chamfer lines shall be finished during the second rubbing.

The first rubbing shall be done soon after form removal. Membrane curing, if used, shall be applied after the first rub is complete. Prior to the second rubbing, any remaining curing membrane shall be removed from the surface by brushing, buffing or other satisfactory methods.

The second rubbing shall be performed when conditioning the structure for final acceptance. The specified surfaces shall be cleaned of drip marks and discolorations and given a final rubbing. The surface shall be striped neatly with a brush and the paste allowed to take a reset, after which the surfaces shall be washed with clean water leaving them with a neat and uniform appearance and texture.

For a one rub system, the rubbing requirements shall be the same as for the first rub above, except chamfer lines shall be finished and the paste spread uniformly, striped with a brush and allowed to take a reset after which the surfaces shall be washed with clean water leaving them with a neat and uniform appearance and texture.

411S.8 - Special Surfaces Finishes

(1) General

When special surface finishes are required for retaining walls, panels, copings or similar construction, the Contractor shall prepare sample panels for approval of the finish and the method of application. Unless otherwise indicated, panel or pattern arrangement and dimensions may be varied to achieve a more pleasing appearance or to utilize forming material more efficiently when approved by the Engineer or designated representative. Aggregates, materials, variation of panel or pattern arrangement, dimensions and other features affecting the work shall be approved prior to start of the work.

(2) Striated Finish

The striated (grooved) pattern shall be as indicated or as approved by the Engineer or designated representative.

The finish shall be made by lining the forms with striated sheets of plywood, plastic, fiberglass, metal or other material acceptable to the Engineer or designated representative. The striations on the panels shall be of a smooth, wide pattern, not sharp or angular.

A chamfer groove shall be used along all edges of each panel. All ties, bolts or other forming accessories shall be located along the chamfer grooves or panel edges.

(3) Exposed Aggregate Finish

(a) Structural Concrete

Exposed aggregate panels may be either raised, recessed or as indicated with the sides of each panel chamfered as directed by the Engineer or designated representative.

The aggregate used for this finish shall be approved by the Engineer or designated representative. Unless otherwise indicated, aggregate shall conform to the grading requirements of Grade 2 aggregate except that a minimum of 50 percent shall be retained on

the ¾-inch (19 mm) sieve. Gravel of predominately rounded particles shall be used, except that when indicated or approved by the Engineer or designated representative in writing, crushed stone may be used. The aggregate shall be large enough to remain firmly anchored in the face of the final product. The depth shall be ¼-inch (6.4 mm) minimum to ½-inch (12.7 mm) maximum, unless otherwise indicated or directed by the Engineer or designated representative.

A surface retarder that penetrates the concrete approximately ¼ (6.4 mm) inch shall be applied to the forms or concrete surface as an aid in achieving the desired finish. Wood forms may require 2 or 3 coatings to compensate for absorption. Form joints shall be taped or caulked to prevent escape of the retarder during placing operations.

Treated form surfaces shall be protected from sun and rain while exposed to the atmosphere. In case of high humidity or if rain has dampened the forms prior to placing concrete, a reapplication of the surface retarder may be required to provide uniform coverage of the retarder on the forms.

Adjacent areas of fresh concrete not requiring exposed aggregate finish shall be protected when the retarder is applied.

The finish shall be obtained by sandblasting, bush hammering, water blasting or other methods, as approved by the Engineer or designated representative. Horizontal surfaces may be finished by a combination of brushing and washing, but only after the concrete has set sufficiently to prevent loosening of the aggregate.

Unless otherwise directed by the Engineer or designated representative, forms for surface requiring exposed aggregate finish shall be removed 12 to 15 hours after concrete placement. The exposed aggregate operation shall be accomplished immediately after form removal. Except for the time required for obtaining the exposed aggregate finish, curing of all surfaces shall be maintained for the minimum 4 day curing time. All surfaces shall be either water cured or may be cured with an approved clean membrane compound. If water curing is used, it shall be followed by a clear membrane curing compound conforming to Item No. 409S, "Membrane Curing".

Care shall be taken to ensure proper vibration at all points of concrete placement to prevent honeycomb or segregation of the materials. Vibration shall be done in such a manner as to provide adequate penetration of previously placed concrete lifts. Care shall be taken to prevent contact of the vibrator with the face form.

(b) Sidewalks

When exposed aggregate surfaces are required for sidewalks, driveways and/or medians, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable. Grade 5 coarse aggregates shall be used for exposed aggregate finishes for sidewalks, driveways and/or medians.

411S.9 - Measurement and Payment

No direct measurement or payment will be made for the work to be done, the equipment or materials to be furnished under this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>
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<u>Standard Specification Item No. 411S, " Surface Finishes for Concrete"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 410S	Concrete Structures
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
DMS-8110	Coatings for Concrete
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
C 144	Aggregate for Masonry Mortar
C 150	Portland Cement
D 445	Kinematic Viscosity of Transparent and Opaque Liquids
D 476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
D 1475	Standard Test Method for Density of Liquid Coatings, Inks and Related Products
D 1544	Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)
D 1652	Standard Test Method for Epoxy Content of Epoxy Resins
D 1726	Standard Test Method for Hydrolyzable Chloride Content of Liquid Epoxy Resins

RELATED CROSS REFERENCE MATERIALS

<u>Standard Specification Item No. 411S, " Surface Finishes for Concrete"</u>

<u>City of Austin Standard Specification Items</u>
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<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finished for Concrete

ITEM NO. 432S - PORTLAND CEMENT CONCRETE SIDEWALKS 1-4-10**432S.1 - Description**

This item shall govern the construction of Portland cement concrete sidewalks (Standard Detail No. 432S-1), as herein specified, on an approved subgrade and in conformance with the lines, grades and details indicated on the Drawings or as established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

432S.2 - Submittals

The submittal requirements of this specification item include:

- A. Class A portland cement (p.c.) concrete mix design,
- B. Type of Installation (i.e. Type I, Type II, etc.) and construction details (i.e. cushion layer, base, reinforcing steel, joints, curing membrane),
- C. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding,
- D. Number, manufacturer, model, construction, finish and installation details of streetscape appurtenances of bicycle racks, benches, chairs, trash receptacles, streetlights, tree wells and above grade tree planters [for sidewalks, 12 feet (3.66 meters) or wider].

432S.3 - Materials**A. Portland Cement Concrete**

Portland cement concrete shall be Class A conforming to Specification Item No. 403S, "Concrete for Structures" or Specification Item No. 407S, "Fibrous Concrete."

B. Reinforcement

Reinforcement shall conform to Specification Item No. 406S, "Reinforcing Steel" or Specification Item No. 407S, "Fibrous Concrete."

C. Expansion Joint Materials

Expansion joint materials shall conform to Specification Item No. 408S, "Expansion Joint Materials."

D. Membrane Curing Compound

Membrane curing compound shall conform to Specification Item No. 409S, "Membrane Curing."

432S.4 - Construction Methods

The subgrade shall be excavated in accordance with Specification Item No. 111S, "Excavation," prepared in accordance with Specification Item No. 201S, "Subgrade Preparation," shaped to the lines, grades and cross section as indicated on the Drawings or as directed by the Engineer or designated representative and thoroughly compacted in accordance with Specification Item No. 201S. A granular cushion of a minimum thickness of 2 inches (50 mm) but maximum thickness of 5 inches (125 mm), composed of crusher screenings, gravel and sand, crushed rock or coarse sand, shall be spread, wetted thoroughly, tamped and leveled. The granular cushion shall be moist at the time the Portland cement concrete is placed.

If the subgrade is undercut by more than 4 inches (100 mm) or the elevation of the natural ground is more than 4 inches (100 mm) below "top of subgrade," then a necessary backfill/embankment layer of an approved material shall be placed and compacted with a mechanical tamper. Hand tamping will not be permitted.

Where the subgrade is rock or gravel, 70% of which is rock; the 2-inch (50 mm) cushion need not be used. The Engineer or designated representative will determine if the subgrade meets the above requirements.

Sidewalk forms shall be constructed of metal or well-seasoned wood not less than 2 inches (50 mm) in thickness, with a section satisfactory to the Engineer or designated representative. The forms shall be clean, straight, and free from warp with a depth equal to the thickness of the finished work. All forms shall be securely staked to line and grade and maintained in a true position during the deposition of Portland cement concrete. Before p.c. concrete is placed, the forms shall be thoroughly oiled with a light form oil.

Expansion joint material $\frac{3}{4}$ inch (19 mm) thick, shall be provided where the new construction abuts an existing structure, sidewalk or driveway. Similar expansion material shall be placed around all obstructions protruding through the sidewalk. The expansion joint material shall be placed vertically and shall extend the full depth of the p.c. concrete. Maximum spacing of expansion joints shall be 40 feet (12 meters) as indicated on the Drawings or as directed by the Engineer or designated representative. Weakened plane joints shall be spaced at 5 feet (1.5 meters) on center. Normal dimensions of the weakened plane joints shall be $\frac{1}{4}$ inch wide and $\frac{3}{4}$ inch deep (6 mm wide and 19 mm deep). All joints shall be constructed perpendicular (90 degrees) to the centerline of walk and shall match any previously placed concrete joints. For sidewalks with widths exceeding 6 feet (1.83 meters) longitudinal weakened-plane tooled joints shall be provided as indicated on the Drawings or as directed by the Engineer or designated representative.

Reinforcement for sidewalks shall consist either of polypropylene fibrillated fibers or 6" x 6" x W1.4 x W1.4 (150mm x 150mm x MW9 x MW9) welded wire fabric or one layer #3 (10M) reinforcing bars, placed no more than 18 inches (450 mm) on center both directions. All reinforcement shall be accurately placed at slab mid-depth, equidistant from the top and bottom of the p.c. concrete and held firmly in place by means of bar supports of adequate strength and number that will prevent displacement and keep the steel at its proper position during the placement of the p.c. concrete. In no instance shall the steel be placed directly on the subgrade or sand cushion layer.

Prior to placement of the concrete, the reinforcement installation shall be inspected by the Engineer or designated representative to ensure conformance with the drawings, specifications and this item. In addition, care shall be exercised to keep all steel in its proper position during placement of the p.c. concrete. If during placement of the concrete, the reinforcement is observed to loose bar support, float upward or move in any direction, the placement shall be stopped until corrective action is taken.

Splices in wire fabric shall overlap sufficiently to allow two pairs of transverse wires to be tied together and no splice of less than 6 inches (150 mm) will be permitted. Splices in the #3 (10M) bars shall have a minimum lap of 12 inches (300 mm).

Where driveways cross sidewalks, additional reinforcing shall be placed in the sidewalk as indicated on the Drawings.

Portland cement concrete sidewalk ramps shall be formed to produce a finished surface with detectable warnings (Standard Detail 432S-2A) in accordance with the requirements of the American Disabilities Act and Texas Accessibility Standards (TAS), including Sections 4.29.2 and A4.29.2. The p.c. concrete sidewalk ramps shall be constructed in accordance with appropriate City of Austin Standard Details (Standard Details 432S-3, 432S-3A through 432S-3H, 432S-5, 432S-5A, 432S-5B, etc.).

Detectable warning for the ramps shall consist of raised truncated domes with a diameter of nominal 0.9 inch (23 mm), a height of nominal 0.2 inch (5 mm) and center-to-center spacing of nominal 2.35 inches

(60 mm) and shall contrast visually with adjoining surfaces, either light on dark or dark-on-light. The material used to provide contrast shall be an integral part of the walking surface.

When indicated on the Drawings or as directed by the Engineer or designated representative, the construction of the sidewalk ramp shall include the installation of interlocking concrete paving units (Standard Specification Item No. 480S, "Concrete Paving Units"). The concrete paving units shall be constructed in accordance with Standard Specification Item No. 485S, "Concrete Paving Units for Sidewalk Ramps" and appropriate City of Austin Standard Details (Standard Details 432S-2A, 432S-3, 432S-3A through 432S-3H, 432S-5, 432S-5A and 432S-5B).

At the proper time after finishing, the surface shall be protected by a membrane, compound curing agent or by wetted cotton or burlap mats, conforming to Item No. 409S, "Membrane Curing." The sides of the p.c. concrete shall be cured in the forms. If the forms are removed during the curing process, the curing shall be continued by the placement of fill against the exposed concrete edges or by other procedures conforming to Item No. 410S, "Concrete Structures." The top 4 inches (100 mm) of fill shall be clean topsoil conforming to Item No. 604S, "Seeding for Erosion Control."

Existing sidewalk that is scheduled for removal and replacement shall be removed and the underlying material shaped to the lines, grades and cross section as indicated in the drawings or as directed by the Engineer or designated representative. The removal and/or relocation of obstructions, including but not limited to signs, trash cans and benches on concrete pads, abandoned manholes, sprinkler control valves and landscaping, shall be performed, as indicated on the drawings, in a manner acceptable to the Engineer or designated representative. Removal and/or relocation of obstructions will be considered incidental work to this item and will not be paid for directly.

Existing PVC pipe drains in and behind curb shall be removed and replaced as required in new sidewalk and/or curb and gutter. In areas of proposed sidewalk construction, where curb and gutter is to remain in place, existing PVC pipe shall be cut far enough behind the back of curb to allow sufficient room for joint fittings to connect to new or salvaged PVC pipe.

The Contractor shall be responsible for removing and replacing mailboxes that are located in the construction area, while assuring that mail delivery will not be interrupted as a result of the construction activities. Mailboxes shall not be laid on the ground.

All necessary excavation, filling and grading of the slopes adjacent to the completed concrete sidewalks will be considered incidental work pertaining to this item and will not be paid for directly. The adjacent excavation and grading of the slopes shall be done in a manner acceptable to the Engineer or designated representative.

432S.5 - Streetscape Furniture Installation Requirements

A. General

Bicycle racks, benches and chairs, trash receptacles, tree wells and above grade tree wells and planters shall only be installed in sidewalks that are 12 feet (3.66 meters) or wider. When installation is indicated on the Drawings or directed by the Engineer or designated representative, these items shall be permanently installed as indicated in Standard Details 710S-4 and 710S-5; 432S-9B; 432S-7C, 432S-7F; and 432S-8B. Above grade tree wells shall be installed in conformance with Standard Detail 432S-7E, while above grade tree planters shall be installed in conformance with Standard Detail Nos. 432S-7D and 432S-7G.

B. Location Requirements

1. Benches.

Benches shall be placed either perpendicular to the curb with the center of the bench on line with trees and light poles and facing toward the building entry, or parallel to the building and within 6" (150 mm) of the building wall, facing out to the street.

Bench siting shall be in conformance with Standard Detail No. 432S-9C in 12' (3.6 M) or wider sidewalks and Standard Detail No. 432S-9D in sidewalks of width between 12' (3.6 M) and 18' (5.4 M).

2. Bike Racks.

Bike racks are to be placed perpendicular to the curb with the centerline of the rack on line with trees and light poles.

Bike rack siting shall be in conformance with Standard Detail No. 710S-6A in 12' (3.6 M) or wider sidewalks and Standard Detail No. 710S-6B in sidewalks of width between 12' (3.6 M) and 18' (5.4 M).

3. Trash Receptacles.

Trash receptacles shall either be placed along the curb, with the center line of the receptacle on line with the trees and light poles, or shall be located at the building entry in alignment with the structural bay system of the building. If located at the entry there shall be no more than 1 foot (300 mm) clearance between the receptacle and the building wall.

Trash receptacle siting adjacent to curb ramps within an intersection shall be in conformance with Standard Detail No. 432S-8C in 12' (3.6 M) or wider sidewalks.

432S.6 - Pedestrian Railing

When a pedestrian railing installation is required along sidewalks for pedestrian protection as indicated on the Drawings or directed by the Engineer or designated representative, this type of pedestrian railing shall be permanently installed in conformance with one of the following designated Standard Details: 707S-1, 707S-2, 707S-3 or 707S-4.

When a pedestrian railing installation is required along portions of sidewalks identified as 'ramps' for ADA accessibility purposes as indicated on the Drawings or directed by the Engineer or designated representative, this type of pedestrian railing shall be permanently installed in conformance with one of the following designated Standard Details: 707S-2, 707S-3 or 707S-4.

432S.7 - Measurement

Accepted work performed as prescribed by this item will be measured by the square foot (square meter: 1 square meter is equal to 10.764 square feet) of surface area of "Concrete Sidewalk."

Accepted work performed as prescribed by "Sidewalk Ramps" will be measured per each for the type of ramp indicated on the Drawings.

Accepted work performed as prescribed by "Streetscape Appurtenances" will be measured per each for the type of appurtenance indicated on the drawings.

Accepted work performed as prescribed by "Pedestrian Railing" will be measured per lineal foot of the type of railing indicated on the Drawings.

432S.8 - Payment

The work performed as prescribed by this item for concrete sidewalk will be paid for at the unit bid price per square foot for "Concrete Sidewalk" and/or "Sidewalks Reconstruction"; per each for "Concrete Sidewalk Ramps" and "Streetscape Appurtenances" or per lineal foot for "Pedestrian Railing".

The unit bid price for new sidewalk shall include full compensation for excavating and/or removal and/or relocating obstructions, vegetating adjacent areas disturbed by sidewalk construction, preparing the

subgrade; for furnishing and placing all materials including cushion material, all reinforcement, bar supports, joints, expansion joint materials, and for any other materials, manipulations, labor, tools, equipment, finishing, curing and incidentals necessary to complete the work.

The unit bid price for sidewalk reconstruction shall include full compensation for excavating and/or removal of existing sidewalk and other obstructions, relocating obstructions, replacing PVC drain pipe, re-vegetating adjacent areas disturbed by sidewalk construction, preparing the subgrade; for furnishing and placing all materials including cushion material, all reinforcement, bar supports, joints, expansion joint materials, and for any other materials, manipulations, labor, tools, equipment, finishing, curing and incidentals necessary to complete the work.

The unit bid price for ramps shall include full compensation for preparing the subgrade when not included as a separate item; for furnishing and placing all materials, manipulation, labor, tools, equipment and incidentals necessary to complete the work. All necessary excavation, filling and grading of the slopes adjacent to the completed concrete paver units will be included in the unit price bid for the item of construction in which this item is used, unless included as a separate pay item in the Contract bid form.

The unit bid price for streetscape appurtenances shall include full compensation for the individual item (i.e. bench, chair, bicycle rack, trash receptacle, street light or above grade tree planter), as well as the removal of existing sidewalk, preparation of footings, furnishing and placing all materials, manipulation and finishing, labor, tools, equipment and incidentals necessary to complete the work.

The unit bid price for pedestrian railing shall include full compensation for the complete installation of the specific pedestrian railing including but not limited to preparation of footings or curb, furnishing and placing all materials, manipulation and finishing, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under one of the following:

New Sidewalks		
Pay Item 432S-4:	New P.C. Concrete Sidewalks, 4 Inch thickness	Per Square Foot.
Pay Item 432S-5:	New P.C. Concrete Sidewalks, 5 Inch thickness	Per Square Foot.
Pay Item 432S-6:	New P.C. Concrete Sidewalks, 6 Inch thickness	Per Square Foot.
Pay Item 432S-7:	New P.C. Concrete Sidewalks, 7 Inch thickness	Per Square Foot.
Sidewalks Reconstruction		

PORTLAND CEMENT CONCRETE SIDEWALKS

Item No. 432S

Pay Item 432SR-4:	Reconstruct Concrete Sidewalks to 4 Inch thickness, including removal of existing sidewalk	Per Square Foot.
Pay Item 432SR-5:	Reconstruct Concrete Sidewalks to 5 Inch thickness, including removal of existing sidewalk	Per Square Foot.
Pay Item 432SR-6:	Reconstruct Concrete Sidewalks to 6 Inch thickness, including removal of existing sidewalk	Per Square Foot.
Pay Item 432SR-7:	Reconstruct Concrete Sidewalks to 7 Inch thickness, including removal of existing sidewalk	Per Square Foot.
Ramps		
Pay Item 432S-RP-1:	P.C. Sidewalk Curb Ramp with Pavers (Type I)	Per Each.
Pay Item 432S-RP-1A:	P.C. Sidewalk Curb Ramp with Pavers (Type IA)	Per Each.
Pay Item 432S-RP-1B:	P.C. Sidewalk Curb Ramp with Pavers (Type IB)	Per Each.
Streetscape Appurtenances		
Pay Item 432S-SAC-1:	Streetscape Bench (___ inches in length)	Per Each.
Pay Item 432S-SAC-2:	Streetscape Chair	Per Each.
Pay Item 432S-SAC-3:	Streetscape Bicycle Rack	Per Each.
Pay Item 432S-SAC-4:	Streetscape Trash Receptacle	Per Each.
Pay Item 432S-SAC-5:	Streetscape Street Light	Per Each.
Pay Item 432S-SAC-7C:	Streetscape Tree Well for Concrete Sidewalks	Per Each.

Pay Item 432S-SAC-7D:	Streetscape Above Grade Tree Planters	Per Each.
Pay Item 432S-SAC-7E:	Streetscape Tree Well with Seat	Per Each.
Pay Item 432S-SAC-7F:	Streetscape Tree Well without Grate	Per Each.
Pay Item 432S-SAC-7G:	Streetscape Above Grade Galvanized Steel Tree Planters	Per Each.
Pesdestrian Railing		
Pay Item 432S-PRC-1:	Pedestrian Railing (Standard 707S-1)	Per LF.
Pay Item 432S-PRC-2:	Pedestrian ADA Railing - Option 1 (Standard 707S-2)	Per LF.
Pay Item 432S-PRC-3:	Pedestrian ADA Railing - Option 2 (Standard 707S-3)	Per LF.
Pay Item 432S-PRC-4:	Pedestrian ADA Railing - Option 3 (Standard 707S-4)	Per LF.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 432S, "Portland Cement Concrete Sidewalks"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 111S	Excavation
Item No. 201S	Subgrade Preparation
Item No. 403S	Concrete for Structures

Item No. 406S	Reinforcing Steel
Item No. 407S	Fibrous Concrete
Item No. 408S	Expansion Joint Materials
Item No. 409S	Membrane Curing
Item No. 410S	Concrete Structures
Item No. 480S	Concrete Paving Unit
Item No. 485S	Concrete Paving Units for Sidewalk Ramps
Item No. 604S	Seeding for Erosion Control
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
432S-1	Sidewalk
432S-2A	Detectable Warning-Paver
432S-3	Type I Curb Ramps-Full Intersection
432S-3A	Type I Curb Ramps-T Intersection
432S-3B	Type IA/IB Curb Ramps-Full Intersection
432S-3C	Type IA/IB Curb Ramps-T Intersection
432S-3D	Combined Curb Ramps-Full Intersection
432S-3E	Combined Curb Ramps-T Intersection
432S-3F	Combined Sidewalk Curb Ramp with Pavers

432S-3G	Combined Sidewalk Curb Ramp with Pavers within Limited ROW
432S-3H	Type I Curb Ramps within PC/PT of Curb and Gutter
432S-5	Type I Sidewalk Curb Ramp
432S-5A	Type IA Sidewalk Curb Ramp
432S-7C	Tree Well for New Trees Planted Within Concrete Sidewalk 3.6 M (12') or Greater
432S-7D	Above Grade Tree Planters
432S-7E	Above Grade Tree Well with Bench
432S-7F	Tree Well Without Grate
432S-7G	Above Grade Galvanized Steel Tree Planters
432S-8B	Trash Receptacle Installation in Concrete Sidewalk
432A-8C	Furnishing Location in 12' (3.6 M) or greater Trash Receptacle Siting
432S-9B	Bench/Chair Installation in Sidewalks
432S-9C	Furnishing Location in 12' (3.6 M) or greater Sidewalks-Bench Siting
432S-9D	Furnishing Location in Greater than 12' (3.6 M) or Less than 18' (5.4 M) Sidewalks-Bench Siting
707S-1	Pedestrian Railing
707S-2	Pedestrian ADA Railing - Option 1
707S-3	Pedestrian ADA Railing - Option 2
707S-4	Pedestrian ADA Railing - Option 3
710S-4	Bicycle Rack Installation in Concrete Sidewalks (Alternate 1)

710S-5	Bicycle Rack Installation in Concrete Sidewalks (Alternate 2)
710S-6A	Furnishing Location in 12' (3.6 M) or greater Sidewalks-Bicycle Rack Siting
710S-6B	Furnishing Location in Greater than 12' (3.6 M) or Less than 18' (5.4 M) Sidewalks-Bicycle Rack Siting

American Disabilities Act, Federal Register; Volume 56, No. 144; July 26, 1991 ADA Accessibility Guidelines For Building And Facilities

<u>Designation</u>	<u>Description</u>
Section 4.29	Detectable Warnings on Walking Surfaces
Section A4.29.2	Detectable Warnings on Walking Surfaces

Architectural Barriers; Texas Civil Statutes, Article 9102; June 14, 1995 Texas Accessibility Standards (TAS)

<u>Designation</u>	<u>Description</u>
Section 4.29	Detectable Warnings on Walking Surfaces
Section A4.29.2	Detectable Warnings on Walking Surfaces

RELATED CROSS REFERENCE MATERIALS

Specification 432S, "Portland Cement Concrete Sidewalks"

City of Austin Standard Contract Documents

<u>Designation</u>	<u>Description</u>
00700	General Conditions
01500	Temporary Facilities
01550	Public Safety and Convenience
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 5.2.3	Utility Adjustments For Roadway Construction Projects
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 132S	Embankment
Item No. 203S	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)

Item No. 236S	Rolling (Proof)
Item No. 360S	Concrete Pavement
Item No. 402S	Controlled Low Strength Material
Item No. 404S	Pneumatically Placed Concrete
Item No. 405S	Concrete Admixtures
Item No. 411S	Surface Finishes for Concrete
Item No. 436S	P.C. Concrete Valley Gutters
Item No. 602S	Sodding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
432S-8A	Trash Receptacle Installation in Concrete Paver Sidewalk
432S-9A	Bench Installation in Concrete Paver Sidewalk
432S-10	Mailbox Placement Detail
433S-1	Type I Driveway (1 & 2 Family Residential Use Only)
433S-1A	Flared Type I Driveway (1 & 2 Family Residential Use Only)
433S-2	Type II Driveway
433S-3	Temporary Driveway

436S-2	Concrete Valley Gutter
470S-1	Curb Cut for Ramp or Driveway (Optional)
710S-3	Bicycle Rack Installation in Concrete Paver Sidewalks (Alternate 1)
1000-8(A)	Typical ROW and Front Lot Utility Assignments
1000-8(B)	Typical Single Service Utility Assignment Details (TV,W,WW)
1000S-10	Local Street Sections
1000S-11	Residential and Neighborhood Collector Street Sections
1000S-12	Primary Collector Street Sections
1000S-13	Minor Arterial Street Sections
1000S-14	Major Arterial Street Sections
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling

Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
<u>American Disabilities Act, Federal Register; Volume 56, No. 144; July 26, 1991 ADA Accessibility Guidelines For Building And Facilities</u>	
<u>Designation</u>	<u>Description</u>
Section 4.3	Accessible Route
Section 4.3.6	Surface Texture
Section 4.3.7 & 4.7.2	Slope
Section 4.3.8 & 4.5.2	Changes in Levels
Section 4.7	Curb Ramps
Section 4.8	Ramps
<u>Architectural Barriers; Texas Civil Statutes, Article 9102; June 14, 1995 Texas Accessibility Standards (TAS)</u>	
<u>Designation</u>	<u>Description</u>
Section 4.3	Accessible Route
Section 4.3.6	Surface Texture
Section 4.3.7 & 4.7.2	Slope
Section 4.3.8 & 4.5.2	Changes in Levels

Section 4.7	Curb Ramps
Section 4.8	Ramps

ITEM NO. 503S - FRAMES, GRATES, RINGS AND COVERS 2-17-00**503S.1 - Description**

This item shall govern furnishing and installation of frames, grates, rings and covers for inlets, manholes and other structures indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

503S.2 - Submittals

The submittal requirements of this specification item include manufacturer, model number, description, painting requirements and characteristics of frames, grates, rings, covers, height adjustment insert and nuts and bolts required for completion of the work.

503S.3 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation in the Work is the kind and quality that satisfies the specified functions and quality. The City of Austin Water and Wastewater Utility Standard Products Lists (SPLs) form a part of these Specifications. Contractors may, when appropriate, elect to use products from the SPLs; however, submittal to the Engineer or designated representative is still required. If the Contractor elects to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal.

The purpose of the SPLs is to expedite the review by the Engineer or designated representative and, if necessary, the City of Austin Water and Wastewater Utility Standard Products Committee of Contractor product submittals. The SPL's should not be interpreted as being a pre-approved list of products necessarily meeting the requirements for a given construction Project. Items contained in the SPL cannot be substituted for items that are shown on the Drawings, called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the Engineer or designated representative in conjunction with the Water and Wastewater Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

A. Welded

Steel Welded steel grates and frames shall conform to the number; size, dimensions and details indicated on the Drawings and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of ASTM A 36/A 36M, "Specification for Structural Steel".

B. Castings

Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron shall conform to the shape and dimensions indicated on the Drawings and shall be clean substantial castings, free from sand or blowholes or other defects. Surfaces of the castings shall be free from burnt on sand and shall be reasonably smooth. Runners, risers, fins and other cast on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. Pairs of machined castings shall be matchmarked to facilitate subsequent identification at installation with the exception of water and wastewater manhole and valve castings. These manhole and valve castings shall be fabricated with such draft, tolerances, bolt hole spacing, etc., that all rings and covers of a particular type or class are interchangeable and match-marking will not be required.

Steel castings shall conform to ASTM A 27/27M, "Specifications for Steel Castings, Carbon, for General Application". Grade 70-36 (480-250) shall be furnished unless otherwise specified on the Drawings.

Cast iron castings shall conform to ASTM A 48, "Specification for Gray Iron Castings", Class 30.

Ductile Iron castings shall conform to ASTM A 536, "Specification for Ductile Iron Castings". Grade 60-40-18 (415-275-125) shall be used unless otherwise indicated on the Drawings.

C. Manhole Cover Riser Rings

Height-adjustment inserts for wastewater manhole rings, which are used for raising standard manhole covers, shall be those models listed in Water and Wastewater Standard Products List item QPL WW-330.

D. Nuts and Bolts

Nuts and bolts shall be hex head 5/8 " × 2.5" (16 mm × 63.5 mm) #11 National Coarse Thread, Type 316 stainless steel. For bolted manhole covers, a thin film of an approved "Anti-freeze" compound, approved by the Engineer or designated representative, shall be applied to all bolts.

E. Mortar

Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand and sufficient water to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for Grade No. 1, Item No. 403, "Concrete for Structures".

503S.4 - Construction Methods

Frames, grates, rings and covers shall be constructed of the specified materials in accordance with the details indicated on the Drawings or in the City of Austin Standard Details. The Frames, grates, rings and covers shall be placed carefully to the lines or grades indicated on the Drawings or as directed by the Engineer or designated representative.

All welding shall conform to the requirements of the ANSI/AWS Structural Welding Code D1.1. Welded frames, grates, rings and covers shall be given 1 coat of a commercial grade red lead oil paint and 2 coats of commercial grade aluminum paint. All coats shall be a minimum of 1.5 mils (0.4 mm), dry.

Painting of gray iron castings will not be required, except when used in conjunction with structural steel shapes.

503S.5 - Measurement and Payment

Frames, grates, rings and covers will not be measured and payment for furnishing all materials, tools, equipment, labor and incidentals to complete the Work will be included in the Bid Items which constitute the complete structures.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item Number 503S, "Frames, Grates, Rings and Covers"</u>	

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures

City of Austin Water and Wastewater Standard Products List

<u>Designation</u>	<u>Description</u>
QPL-WW-330	Manhole Cover Riser Rings for raising City of Austin Standard Manhole Covers

American Society for Testing Materials (ASTM)

<u>Designation</u>	<u>Description</u>
A36/A36M	Specification for Structural Steel
A27/A27M	Specification for Steel Castings, Carbon, for General Application
A48	Specification for Gray Iron Castings
A536	Specification for Ductile Iron Castings

ANSI/AWS

<u>Designation</u>	<u>Description</u>
Code D 1.1	Structural Welding Code

RELATED CROSS REFERENCE MATERIALS

<u>Standard Specification Item Number 503S, "Frames, Grates, Rings and Covers"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 504S	Adjusting Structures
Item No. 510	Pipe
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 503S-1	457mm (18") Cover and Frame
No. 503S-2S	Storm Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-2W	Sanitary Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-3S	Bolted Storm Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-3W	Bolted Sanitary Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-4S	Storm Sewer Manhole Ring and 813 mm (32") Cover
No. 503S-4W	Sanitary Sewer Manhole Ring and 813 mm (32") Cover
No. 503S-5S	Bolted Storm Sewer Manhole Ring and 813 mm (32") Cover
No. 503S-5W	Watertight Manhole Ring and 813 mm (32") Cover
No. 506S-2	Major Manhole Adjustment
No. 506S-11	Storm Sewer Manhole Details

<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 421	Portland Cement Concrete

ITEM NO. 506 - MANHOLES 3-15-11

506.1 - Description

This item governs construction of pre-cast and cast-in-place wastewater manholes, storm water manholes, storm water junction boxes and cast-in-place wastewater junction boxes, complete in place, including excavation, installation, backfilling and surface restoration; required items including rings, covers, coatings, and appurtenances; and incidental work such as pumping and drainage necessary to complete the work. Contractor-performed acceptance testing is required for wastewater manholes.

506.2 - Qualifications

Applicators of coatings to the interior surfaces of wastewater manholes, as specified in 506S.4.R and 506S.5.J, shall be listed on Standard Products List WW-511.

506.3 - Project Submittals

A. Products and Materials

The Contractor shall submit descriptive information and evidence that the materials the Contractor proposes for incorporation in the Work are of the kind and quality that satisfy the requirements in the Contract Documents. The City of Austin Water Utility Standard Products Lists are considered a part of the Specifications for the Work. The Contractor shall use products from the SPLs for all water and wastewater construction unless alternative products are shown on the Drawings; called for in the specifications; or specified in the Bidding Requirements, Contract Forms and Conditions of the Contract.

The products included in the Standard Products Lists current at the time of plan approval shall govern; unless a specific product or products on the lists have subsequently been removed from those SPLs because of quality or performance issues. Products and materials that are not covered by SPLs shall meet the requirements in the contract documents.

Submittals for the products and materials covered by this specification shall include manufacturer catalog sheets, technical data sheets, shop drawings, product or material test results, requirements listed below, and any other information needed to adequately describe the product or material. For products covered by SPLs, the submittal shall include a copy of the applicable SPL with the proposed product identified. An SPL by itself is not considered an adequate submittal.

The submittal requirements of this specification item include:

1. For pre-cast manholes and junction boxes: shop drawings for each structure showing, at a minimum, the Project and Contractor's name; manufacturer's name and plant location; applicable specifications; list of materials (such as adjusting rings, boots, gaskets, and pre-cast sections) by type and quantity; elevation view showing diameter or size, ring and cover size and elevation, ring type (bolted or unbolted, flared top or flared bottom) wall thickness, elevations of transitions from large diameter sections to smaller diameter sections, base width and thickness, total depth, size of openings, reinforcement, and length of each pre-cast section; structure identification number and station location; pipe line identification; pipe material and size; pipe flowline elevations; plan view showing azimuthal orientation (based on 360 degrees clockwise) of the pipes relative to the outflow pipe; technical data sheets covering pipe-to-manhole or pipe-to-junction box connectors, and gaskets
2. For cast-in-place manholes and junction boxes: formwork drawings sealed by a registered Professional Engineer licensed in the State of Texas with documented experience in formwork design for wall pours that exceed 4 feet in height and slabs that are not ground supported
3. For hydraulic cement concrete; mix components and proportions, material sources, materials test results

4. For mortar: mix components and proportions, material sources, materials test results
5. For non-shrink grout: technical data sheet indicating ASTM type and containing instructions on surface preparation, mixing, placing, and curing procedures
6. For wastewater manhole coatings and linings: technical data sheets that include instructions on surface preparation, mixing, placing, and curing procedures

B. Acceptance Test Records

Submittal of acceptance test records is required for wastewater manholes and shall include as a minimum the following items:

Name of the manhole manufacturer

Interior surface coating type and application method

Model and manufacturer of vacuum tester

Date tested/date re-tested

Indication of whether test passed or failed and statement of corrective action taken if test failed

Test Method Used

Location/station of manhole

Type of base: Precast/cast-in-place

Type of repairs made to the joints

The test records shall also be included as part of the Project records turned in with the acceptance package.

506.4 - Materials

A. Concrete

All cast-in-place concrete shall conform to City of Austin Standard Specification Item No. 403S, "Concrete for Structures." Cast in place concrete shall be Class A or as specified on the Drawings. Concrete used in precast concrete manhole base sections, riser sections and appurtenances shall conform to the requirements of Texas Department of Transportation Item 421, Hydraulic Cement Concrete. Concrete for backfill of over-excavated areas shall be City of Austin Class A, or Class J (City of Austin Standard Specification Item 403S, Concrete For Structures) or Controlled Low Strength Material (City of Austin Standard Specification Item 402S) as indicated on the Drawings.

B. Mortar

Mortar shall be composed of one part Portland cement, one part masonry cement (or ¼ part hydrated lime), and sand equal to 2½ to 3 times the sum of the volumes of the cements and lime used. The sand shall meet the requirements for "Fine Aggregate" as given in Standard Specification Item No. 403S "Concrete For Structures." Mortar shall not be used for any purpose on the inside of wastewater manholes.

C. Grout

Grout shall be the non-shrink type conforming to ASTM C 1107, Packaged, Dry, Hydraulic Cement Grout (Nonshrink), Grade C. Grout shall be used as packaged, with the mixed ingredients requiring only the addition of water.

D. Reinforcement

The reinforcing steel shall conform to the requirements of Standard Specification Item No. 406S, "Reinforcing Steel." Secondary, non-structural steel in cast-in-place stormwater manholes may be replaced by collated fibrillated polypropylene fibers, if approved by the Engineer or designated representative.

E. Brick

The brick for ring adjustment courses and for stormwater manholes shall be of first quality, sound, hard burned, perfectly shaped brick conforming to the requirements of ASTM C 62, Grade SW, or concrete brick meeting the requirements of ASTM C 55, Grade N-1.

F. Rings and Covers

Rings and covers shall conform to the requirements of City of Austin Standard Specification Item No. 503S, "Frames, Grates, Rings and Covers."

1. Replacement Rings and Covers, 24 in Diameter Lids

This ring and cover shall be used for the replacement of broken rings and covers, minor manhole adjustment, or as otherwise directed by the Engineer or designated representative.

2. Rings and Covers, 32 in. Diameter Lids

This ring and cover shall be used for all new manhole construction, except as otherwise directed by the Engineer or designated representative.

G. Bulkheads

Bulkheads shall meet the requirements of City of Austin Standard Specification Item No. 507S "Bulkheads."

H. Precast Base Sections, Riser Sections, Flat-top Slabs and Cones

Precast concrete base sections, riser sections, flat-top slabs, and cones shall conform to the requirements of ASTM C 478. The width of the invert shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped channels. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, shall be a minimum of three fourths of the diameter of the pipe, with the top of the channel being a smooth transition between the inlet and outlet pipe connection points. For manholes connecting to pipes larger than 24 inches in diameter, the channel depth at the point where a pipe connects to the manhole wall shall be at least equal to the full pipe diameter. Changes in flow direction in the inverts of manholes shall be made by constructing smooth, long-radius sweeps to minimize splashing, turbulence, and eddies. The manhole invert grade shall 1) be a continuation of the inlet and outlet pipe grades carried through to the centerline of the manhole, or 2) have a minimum slope of 2.5 percent between the inlet and outlet pipe inverts, or 3) have a minimum difference of 0.10 feet between the inlet and outlet pipe inverts, whichever provides the maximum difference in invert elevation between the inlet and outlet pipes. In all cases, the bottom(s) of the channel(s) shall provide a smooth transition between the inlet and outlet pipes. Where wastewater lines enter a manhole above the flowline of the outlet, the invert shall be filleted to prevent splashing and solids deposition.

Joints for wastewater base sections, riser sections, and cones shall conform to the requirements of ASTM C 443. Additionally, joint dimensions for 48-inch inside diameter wastewater manhole sections and cones shall comply with City of Austin Standard No. 506S-13, "Wedge Seal Joint Detail, Precast Manhole Section." Joint dimensions for wastewater manhole sections and cones larger than 48-inch inside diameter shall comply with City of Austin Standard No. 506S-12, "O-Ring Joint Detail Precast Manhole Section" or City of Austin Standard No. 506S-13, "Wedge Seal Joint Detail, Precast Manhole Section". Precast bases for 48 inch inside diameter manholes shall have preformed inverts. Inserts acceptable to the Engineer or designated representative shall be embedded in the concrete

wall of the manhole sections to facilitate handling; however, through-wall holes for lifting will not be permitted.

I. Precast Junction Boxes

Precast junction boxes shall be allowed only where indicated on the Drawings or acceptable to the Engineer or designated representative.

J. Pipe-to-Manhole and Pipe-to-Junction-Box Connectors

Resilient connectors, ring waterstops, and seals at connections of wastewater pipes to pre-cast and cast-in-place manholes and junction boxes shall be watertight, flexible, resilient and non-corrosive, conforming to ASTM C 923. Metallic mechanical devices for securing the connectors, ring waterstops, and seals in place shall be Type 304 stainless steel.

K. Precast Flat-Slab Transition/Junction Box Lids

Precast slab transitions and lids shall be designed to safely resist pressures resulting from loads which might result from any combination of forces imposed by an HS-20 loading as defined by the American Association of State Highway and Transportation Officials (AASHTO). The joints of precast slab transitions and of lids for wastewater applications shall conform to the requirements of ASTM C443.

L. Precast-Prefabricated Tee Manholes

Tee manholes shall be allowed only where indicated on the Drawings or as directed by the Engineer or designated representative. The main pipe section shall conform to the requirements of City of Austin Standard Specification Item No. 510, "Pipe." The vertical manhole portion (tee) above the main pipe shall conform to the requirements of the precast components.

The manhole tee shall have a minimum inside diameter of 48 inches and shall rise vertically centered or tangent to the main pipe, as indicated on the Drawings or as directed by the Engineer or designated representative. An access hole less than 48-inches in diameter shall be cut into the main pipe to allow a ledge for support of access ladders. Unless otherwise specified on the Drawings, the main pipe portion of the tee manhole shall be included in the unit price bid for the unit tee manhole price.

M. Precast Grade Rings

Rings shall be reinforced Class A concrete

1. Precast Grade Rings, 24½ inches Inside Diameter

This adjustment ring shall be used only for adjusting existing manholes with 24 inch diameter lids and for Wastewater Access Device. Inside to outside diameter dimension of ring shall be 6 inches with a thickness of 3 inches to 6 inches.

2. Precast Grade Rings, 35 inches Inside Diameter

This adjustment ring shall be used for all new manhole construction with 32 inch diameter lids. Inside to outside diameter dimension of ring shall be 6 inches with a thickness of 2 inches to 6 inches.

N. High Density Polyethylene Grade Rings

Plastic grade (adjusting) rings shall be injection molded from high density polyethylene identified according to ASTM D4976. Reprocessable and recyclable ethylene plastic materials are allowed. Manufacturers of HDPE adjusting rings shall be listed on SPL WW-703.

O. Controlled Low Strength Material

Controlled low strength material (CLSM) shall meet Standard Specification Item 402S, Controlled Low Strength Material.

P. Cement Stabilized Sand

Cement stabilized sand for bedding or backfilling shall contain 2 bags of Portland cement per cubic yard. The sand shall meet the requirements for "Fine Aggregate" in Standard Specification Item 403S, Concrete for Structures.

Q. Waterproofing Joint Materials

O-rings and wedge seals for the joints of all wastewater manholes, and for stormwater manholes when indicated on the Drawings, shall conform to the requirements of ASTM C443. Cold applied preformed plastic gaskets for stormwater manholes shall be as specified in City of Austin Standard Specification Item No. 510, "Pipe." Plastic seals wrapped around manholes at joints, and hydrophillic waterstops installed in joints, shall be listed on SPL WW-146A. PVC waterstops installed in joints and waterproofing compounds applied to the exterior surfaces of manholes and junction boxes shall be as specified in the Contract Documents.

R. Interior Surface Coatings for Wastewater Manholes

Interior surface coatings for wastewater manholes shall be either: as specified on the Drawings, as designated in writing by the Engineer or designated representative, or as included on SPL WW-511, which lists acceptable products, uses and applicators.

S. Structural Lining Systems for Wastewater Manholes

Structural lining systems for wastewater manholes shall be either: as specified on the Drawings, as designated in writing by the Engineer or designated representative, or as included on SPL WW-511A.

506.5 - Construction

A. General

A minimum horizontal separation of 12 inches shall be maintained between adjacent pipes inside and outside a manhole or junction box. Pipe ends within the base section or junction box walls shall not be relied upon to support overlying manhole dead and live load weights. All wastewater branch connections to new or existing mains shall be made at manholes, with the branch pipe crown installed at an elevation no lower than the elevation of the effluent pipe crown. Changes in flow direction in the inverts shall be made by constructing smooth, long-radius sweeps to minimize splashing, turbulence, and eddies. Where wastewater lines enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be sloped upward in a U-shaped channel three-fourths of the diameter of the incoming pipe to receive the flow, thus preventing splashing or solids deposition. A drop pipe shall be provided for a wastewater pipe entering a manhole whenever the invert cannot be constructed to prevent splashing and solids deposition. Construction of extensions to existing systems shall require placement of bulkheads at locations indicated or directed by the Engineer or designated representative.

Unless otherwise indicated on the Drawings, stormwater manholes shall have eccentric cones and wastewater manholes shall have concentric cones, except on manholes over large mains where an eccentric cone shall be situated to provide access to an invert ledge. Eccentric cones may be used where conflicts with other utilities dictate. Flat-slab tops may be used only where clearance problems are encountered or where specified on the Drawings. Cast-in-place wastewater junction boxes shall be allowed only where indicated on the Drawings or where accepted by the Engineer or designated representative.

B. Foundation Support

Manholes shall be founded at the established elevations on uniformly stable subgrade. Unstable subgrade shall be over-excavated a minimum of 12 inches and replaced with a material acceptable to the Engineer or designated representative. Precast base units shall be founded and leveled on a 6 inch thick layer of coarse aggregate bedding. A pipe section with a prefabricated tee manhole and half the length of the adjoining pipe sections on each side shall be founded on a minimum of 6 inch thick layer of unreinforced Class A concrete (City of Austin Standard Specification Item No. 403S, "Concrete For Structures"). The cast-in-place concrete cradle shall be placed against undisturbed trench walls up to the pipe's springline.

C. Cast-in-Place Concrete

Structural concrete work shall conform to Standard Specification Item No. 410S, Concrete for Structures. Forms shall be used for all slabs that are not ground supported and for all vertical surfaces above the foundation level. Formwork shall be designed according to American Concrete Institute ACI 347, Guide to Formwork for Concrete. Outside forms on vertical surfaces may be omitted where concrete can be cast against the surrounding earthen material that can be trimmed to a smooth vertical face.

D. Manhole Bases

Pre-cast bases shall conform to requirements in 506.4.H.

Cast-in-place bases shall have a minimum thickness of 12 inches at the invert flowline. The widths of all manhole inverts shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped channels. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, shall be a minimum of three-fourths of the pipe diameter, with the top of the channel being a smooth transition between the inlet and outlet pipe connection points. For manholes connecting to pipes greater than 24 inches in diameter, the channel depth at the point where a pipe connects to the manhole wall shall be equal to the full pipe diameter. The manhole invert grade shall 1) be a continuation of the inlet and outlet pipe grades carried through to the centerline of the manhole, or 2) have a minimum slope of 2.5 percent between the inlet and outlet pipe inverts, or 3) have a minimum difference of 0.10 feet between the inlet and outlet pipe inverts, whichever provides the maximum difference in invert elevation between the inlet and outlet pipes. In all cases, the bottom(s) of the channel(s) shall provide a smooth transition between the inlet and outlet pipes. Changes in flow direction in the inverts of manholes shall be made by constructing smooth, large-radius sweeps to prevent splashing, turbulence, and eddies. The lowermost riser section may be set in the Portland cement concrete, while still plastic, after which the base shall be cured a minimum of 24 hours prior to proceeding with construction of the manhole up to 12 feet in depth. The base shall be cured an additional 24 hours prior to continuing construction above the 12-foot level.

Wastewater manholes having cast-in-place bases may be constructed over existing wastewater pipes and the top half of the pipe removed to facilitate invert construction, except where the existing pipe is PVC, in which case, the entire pipe shall be removed from inside the manhole. The manhole floor shall rise outwardly from the springline elevation of the pipe, approximately one inch for each 12 inch of run (8 percent slope). The floors of stormwater manholes, also, shall rise outwardly from the springline elevation of the pipe, approximately one inch for each 12 inches of run (8 percent slope).

Wastewater manholes with lines larger than 18 inches shall require pre-cast bases; manholes constructed over in-service mains however, may be built on cast-in-place bases if the flow cannot be interrupted.

E. Pipe Connections to Manholes and Junctions Boxes

Wastewater pipe connections to manholes and junction boxes shall be made using flexible, resilient, and non-corrosive watertight boot connectors or ring waterstops acceptable to the Engineer and conforming to the requirements of ASTM C-923. Any voids in the annular space between the pipe

and boot connector or ring waterstop and the inside of the manhole wall shall be filled with non-shrink grout to prevent solids collection.

F. Pipe Connections to Existing Manholes and Junction Boxes

Wastewater pipe connections to existing manholes and junction boxes shall be made by removing the wall section by coring or alternative method approved by the Engineer or designated representative; installing flexible, resilient, and non-corrosive boot connectors or ring waterstops acceptable to the Engineer or designated representative and conforming to the requirements of ASTM C-923; filling any voids in the annular space between the pipe and boot connector or ring waterstop and the inside of the manhole or junction box wall with non-shrink grout; rebuilding the invert to conform to Section 506S.5.D; rehabilitating the interior walls with structural lining material listed on SPL WW-511A, and coating the interior of the manhole with material listed on SPL WW-511.

G. Waterproofing

PVC waterstops, hydrophilic waterstops, joint wrapping, and waterproofing compounds shall be installed as specified. Material wrapped around manholes at joints shall be listed on SPL WW-146A regardless of whether installation of the material is required by the Contract for waterproofing or is volunteered by the Contractor for ensuring acceptance of the manhole joints.

H. Backfilling

Backfilling of manholes shall conform to the density requirements of City of Austin Standard Specification Item No. 510, Pipe. Manhole construction in roadways may be staged to facilitate pavement base construction. Manholes constructed to interim elevations to facilitate interim construction shall be covered with steel plates that conform to the requirements of City of Austin Standard 804S-4, sheets 5, 6 and 7, Steel Plating. Steel plates on wastewater manholes shall be set in mortar to minimize inflow of storm water runoff. Manholes shall be completed to finish elevation prior to placement of the roadway's finish surface except on pavement reconstruction projects, where castings may be adjusted after paving is completed. The excavation for completion of manhole construction shall be backfilled in accordance with City of Austin Standards for Trench Repair.

I. Height Adjustment of Manholes

1. General

All adjustments shall be completed prior to the placement of the final roadway surface except on pavement reconstruction projects, where castings may be adjusted after paving is completed.

Brick shall not be used in making height adjustments to wastewater manholes. Mortar shall not be used for any purpose on the inside of wastewater manholes.

Manhole components to be reused shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its expense.

If the adjustment involves lowering the top of a manhole, a sufficient depth of pre-cast concrete rings or brick courses shall be removed to permit reconstruction. Existing mortar shall be cleaned from the top surface remaining in place and from all brick or concrete rings to be reused and the manhole rebuilt to the required elevation. The manhole ring and cover shall then be installed with the top surface conforming to the proposed grade.

If the adjustment involves raising the elevation of the top of the manhole in accordance with Minor Manhole Height Adjustment," the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings or bricks and the ring and cover installed with the top surface conforming to the proposed grade.

After rings and covers are set to grade, the inside and outside of the precast concrete grade rings shall be wiped with non-shrink grout to form a durable surface and water-tight joints. The grouted surface shall be smooth and even with the manhole cone section. Grout shall not be placed when the atmospheric temperature is at or below 40°F. If a sudden drop in temperature below 40°F occurs or temperatures below 40°F are predicted, the grouted surfaces shall be protected against freezing for at least 24 hours.

2. Minor Manhole Height Adjustment (New and Existing Manholes)

Minor manhole height adjustments shall be performed as indicated on City of Austin Standard 506S-4, "Minor Manhole Height Adjustment", and shall consist of adding precast reinforced concrete rings to adjust new and existing manholes to final grade. Brick shall not be used in making height adjustments to wastewater manholes.

If the adjustment involves raising the elevation of the top of the manhole, the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings or bricks and the ring and cover installed with the top surface conforming to the proposed grade.

For new manhole construction, the maximum allowable throat or chimney height, including the depth of the ring casting, shall be limited to 21 inches of vertical face on the interior surface. For adjustments of existing manholes that fall within the limits of overlay and street reconstruction projects, the maximum vertical allowable height, including the depth of the ring casting, shall be limited to 27 inches of vertical face on the interior surface. All other existing manholes shall have a maximum allowable throat or chimney height adjustment, including the depth of the ring casting, of 12 inches of vertical face on the interior surface. Any adjustment that will exceed these requirements shall be accomplished as indicated on City of Austin Standard 506S-2, Major Manhole Height Adjustment and as described below. Manholes not located in paved areas shall have bolted covers. Manholes located within paved areas (street right of way only) shall be standard non-bolted unless otherwise noted on the drawings.

3. Major Manhole Height Adjustment (Existing Manholes Only)

Any adjustment that exceeds the requirements of Minor Manhole Adjustments, shall be accomplished as indicated on City of Austin Standard 506S-2, Major Manhole Height Adjustment, and shall consist of any combination of removing the concrete rings, and/or the manhole cone section, and/or the straight riser section of the manhole in order to bring the manhole to final grade. Major manhole adjustments shall apply only to existing manholes. Manholes not located in paved areas shall have bolted covers. Manholes located within paved areas (street right of way only) shall be standard non-bolted unless otherwise noted on the drawings.

J. Interior Coatings of Wastewater Manholes and Junction Boxes

The interior surfaces of all Portland cement concrete wastewater manholes and junction boxes shall be coated with products specified either on the Drawings, designated in writing by the Engineer or representative, or listed on SPL WW-511. Product selection shall conform to usage described in that SPL. Surface preparation shall follow the product manufacturer's recommended procedures contained in technical data sheets unless otherwise specified in the contract documents. The Contractor shall measure the coating thickness according to ASTM D 6132, Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Over Concrete Using an Ultrasonic Gage. Thickness measures shall be made at locations designated by the Engineer or designated representative. All thickness measurements shall be witnessed by the Engineer or designated representative.

K. Structural Linings of Existing Wastewater Manholes

The interior surfaces of existing wastewater manholes and junction boxes at locations shown in the Drawings or as designated by the Engineer shall be strengthened by application of structural lining systems either as specified on the Drawings, directed in writing by the Engineer or designated representative, or listed on SPL WW-511A. Selection of products for coating the interior of existing manholes shall be based on the condition of the manholes. Surface preparation shall follow the product manufacturer's recommended procedures contained in technical data sheets unless otherwise specified in the contract documents.

L. Abandonment of Existing Manholes

Manholes designated on the Drawings for abandonment, shall be removed to a level not less than four feet below grade. Two-foot long sections of the inlet and outlet pipes shall be cut and removed on the outside of the manhole, the ends of the remaining pipe and the pipe sections penetrating the manhole wall shall be securely plugged, and the structure filled with material in accordance with Standard 506S-15 or as directed by the Engineer or designated representative.

506.6 - Acceptance Testing of Wastewater Manholes

Manholes shall be tested separately and independently of the wastewater lines.

A. Test by the Vacuum Method

A vacuum test shall be performed by the Contractor prior to backfilling those manholes that fall within the right-of-way that require detouring of vehicular traffic. A second vacuum test will not be required after backfilling and compaction is complete unless there is evidence that the manhole has been damaged or disturbed subsequent to the initial vacuum test.

For manhole installations which do not require detouring of vehicular traffic, the vacuum method is recommended and may be used by the Contractor prior to backfilling the manhole to insure proper installation so that defects may be located and repaired; however, a vacuum test shall be performed after backfilling, and compaction are complete. Testing after backfill and compaction are complete will be the basis for acceptance of the manhole.

1. Equipment

- a) The manhole vacuum tester shall be a device approved for use by the Engineer or designated representative.
- b) Pipe sealing plugs shall have a load resisting capacity equal to or greater than that required for the size of the connected pipe to be sealed.

2. Procedures - applicable to new 48-inch diameter manholes

- a) Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before installation or unless it is applied at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints. Tests shall be performed before grouting the invert or around pipe penetrations and before coating the interior surfaces of the manhole or junction box.
- b) After cleaning the interior surfaces of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer. Plugs and the ends of pipes connected by flexible boots shall be blocked to prevent their movement during the vacuum test.
- c) The vacuum test head shall be placed on the top of the cone section or, inside of the top of the manhole cone section, and the compression seal band inflated to the pressure recommended by its manufacturer. The vacuum pump shall be connected to the outlet port

with the valve open. When a vacuum of 10 inches of mercury (-5 psig) has been attained, the valve shall be closed and the time noted. Tampering with the test equipment will not be allowed.

- d) The manhole shall have passed the test if the vacuum does not drop below 9 inches of mercury (-4.5 psig) within 3 minutes of the time the valve was closed. The actual vacuum shall be recorded at the end of the 3 minutes during which the valve was closed.
- e) When the standard vacuum test cannot be performed because of design or material constraints (examples: T-Type manholes, T-Lock Liners, or other reasons acceptable to the Engineer or designated representative), testing of individual joints shall be performed as directed by the Engineer or designated representative.

B. Test by the Exfiltration Method

At the discretion of the Engineer or designated representative, the Contractor may substitute the Exfiltration Method of testing for the Vacuum test described in Section 506.6. A. above. This method may only be used when ground water is not present. If ground water is present a Vacuum Test shall be used unless otherwise directed by the Engineer or designated representative. All backfilling and compaction shall be completed prior to the commencement of testing.

The procedures for the test shall include the following:

1. Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before field assembly, or at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints. Tests shall be performed before grouting the invert or around pipe penetrations and before coating the interior surfaces of the manhole or junction box.
2. After cleaning the interior surface of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer.
3. Concrete manholes shall be filled with water or otherwise thoroughly wetted for a period of 24 hours prior to testing.
4. At the start of the test, the manhole shall be filled to the top with water. The test time shall be 1 hour. The Construction Inspector must be present for observation during the entire time of the test. Permissible loss of water in the 1-hour test time is 0.025 gallons per diameter foot, per foot of manhole depth. For a 4-foot diameter manhole, this quantity converts to a maximum permissible drop in the water level (from the top of the manhole cone) of 0.1 inches per foot of manhole depth or 1.0 inches for a 10-foot deep manhole.

C. Failure to Pass the Test - Records of Tests

If the manhole fails to pass the initial test method as described in (A) Test by the Vacuum Method and, if allowed, (B) Test by the Exfiltration Method, or if visible groundwater leakage into the manhole is observed, the Contractor shall locate the leak, if necessary by disassembly of the manhole. The Contractor shall check the gaskets and replace them if necessary. The Contractor may re-lubricate the joints and re-assemble the manhole, or the Contractor may install an acceptable exterior joint sealing product (see City of Austin Standard Products List Item SPL WW-146A) on all joints and then retest the manhole. If any manhole fails the vacuum and/or exfiltration test twice, the Contractor shall consider replacing that manhole. If the Contractor chooses to attempt to repair that manhole, the manhole must be retested until it passes. In no case shall cold applied preformed plastic gaskets be used for repair. Records of all manhole testing shall be made available to the Engineer or designated representative at the close of each working day, or as otherwise directed by the Engineer or designated representative. Any damaged or visually defective products, or any products out of acceptable tolerance shall be removed from the site.

D. Inspection

The Engineer or designated representative shall make a visual inspection of each manhole after it has passed the testing requirements and is considered to be in its final condition. The inspection shall determine the completeness of the manhole; any defects shall be corrected to the satisfaction of Engineer or designated representative.

506.7 - Measurement

A "Junction Box" and "Box Manholes" will be measured by each structure of the indicated size regardless of depth.

A "Standard Pre-cast Manhole with Pre-cast Base", "Standard Pre-cast Manhole with Cast-in-Place (CIP) Base", "Special Manhole", "Drop Manhole with Pre-cast Base", "Drop Manhole with Cast-in-Place (CIP) Base", "Centered Tee Manhole", or "Tangent Tee Manhole" will be measured by each structure of the indicated size for the first 8 feet of depth.

An "Extra Depth Manhole" will be measured by linear vertical foot of Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole of the indicated size in excess of eight feet of depth. Manhole depth will be measured from the invert flow line to the finished surface elevation.

"Minor Manhole Height Adjustment" and "Major Manhole Height Adjustment" will be measured by each unit for the indicated size. Only existing manholes will be measured for minor or major manhole height adjustment.

"Connection to Existing Manhole or Junction Box" will be measured per each for the indicated type of structure and location.

"Structural Lining" will be measured by the linear vertical foot for the indicated structure.

New manholes constructed to interim elevations to facilitate stage construction shall be measured as one unit regardless of the number of interim elevations constructed. All labor, materials and other expenses necessary for the stage construction shall be included in the unit price bid for the completed unit. Cost of abandonment of existing manholes shall be included in the unit price bid for the completed unit, unless Pay Item No. 506 AB is indicated on the Drawings and identified in Standard Contract Bid Form 00300U.

506.8 - Payment

Payment for completed junction boxes and manholes of the type indicated on the Drawings shall be made at the appropriate unit bid price. The unit bid price shall include all labor, equipment, materials, (including but not limited to frames and grates, rings and covers, adjusting rings, cone sections, riser sections, gaskets, drop piping and fittings, bases, pipe-to-manhole connectors, concrete, reinforcing steel, non-shrink grout, mortar, joint wrap where specified, and, for wastewater manholes, interior coatings), time and incidentals necessary to complete the work.

Payment for a "Junction Box" and "Box Manhole" will be made at the unit price bid for the indicated size, complete in place.

Payment for the first 8 feet of a "Standard Pre-cast Manhole with Pre-cast Base", "Standard Pre-cast Manhole with Cast-in-Place (CIP) Base", "Special Manhole", "Drop Manhole with Pre-cast Base", "Drop Manhole with Cast-in-Place (CIP) Base", "Centered Tee Manhole", or "Tangent Tee Manhole" will be made at the unit price bid for the indicated type and size, complete in place.

Payment for that portion of a Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole,

Centered Tee Manhole, or Tangent Tee Manhole in excess of 8 feet in depth will be made at the unit price bid for "Extra Depth Manhole" of the indicated type and size, complete in place.

Payment for "Minor Manhole Height Adjustment" and "Major Manhole Height Adjustment" will be made at the unit bid price, complete in place.

Payment for "Structural Lining" will be made at the unit price per linear vertical foot, which will include surface preparation, environmental adjustments, lining application, and curing, as required.

Payment for "Connection to Existing Manhole or Junction Box" shall be made at the unit price per connection and will include removing the wall section by coring or alternative method approved by the Engineer or designated representative, rehabilitating the interior walls, rebuilding the invert, and preparing and coating the interior surfaces of the structure.

When indicated in the Drawings, abandonment of existing manholes shall be made at the unit price for abandonment.

The intended use of each item shall be designated by a two-letter code (Wastewater = WW; Stormwater = SW) in the spaces provided after the pay item number:

Pay Item No. 506S M___:	Standard Pre-cast Manhole w/Pre-cast Base, ___ Dia.	Per Each.
Pay Item No. 506S M1___:	Standard Pre-Cast Manhole w/CIP Base, ___ Dia.	Per Each.
Pay Item No. 506S S___:	Special Manhole, ___ Dia.	Per Each.
Pay Item No. 506S D___:	Drop Manhole w/Pre-cast Base, ___ Dia.	Per Each.
Pay Item No. 506S D1___:	Drop Manhole w/CIP Base, ___ Dia.	Per Each.
Pay Item No. 506S C___:	Centered Tee Manhole, ___ Dia. × ___ Dia.	Per Each.
Pay Item No. 506S T___:	Tangent Tee Manhole, ___ Dia. × ___ Dia.	Per Each.
Pay Item No. 506S J___:	Junction Box, ___ Ft. × ___ Ft.	Per Each.
Pay Item No. 506S B___:	Box Manhole ___ Ft. × ___ Ft.	Per Each.
Pay Item No. 506S 2___:	Major Manhole Height Adjustment, ___ Dia.	Per Each.
Pay Item No. 506S 4___:	Minor Manhole Height Adjustment, ___ Dia.	Per Each.
Pay Item No. 506S AB___:	Abandonment of existing Manholes:	Per Each.

Pay Item No. 506S EDM___	Extra Depth of Manhole, ___ Dia.	Per Linear Vert. Foot.
Pay Item No. 506S SL___:	Structural Lining of ___:	Per Linear Vert. Foot.
Pay Item No. 506S CN___:	Connection to Existing ___:	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 506, "Manholes"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 403S	Concrete For Structures
Item 406S	Reinforcing Steel
Item 402S	Controlled Low Strength Material
Item 410S	Concrete Structures
Item 503S	Frames, Grates, Rings and Covers
Item 504S	Adjusting Structures
Item 507S	Bulkheads
Item 510	Pipe

Texas Department of Transportation Standard Specifications For Construction and Maintenance of Highways, Streets and Bridges

<u>Designation</u>	<u>Description</u>
Item 421	Hydraulic Cement Concrete

City of Austin Utilities Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 2.8.0	Abandonment of Facilities
Subsection 2.8.2	Manholes

City of Austin Water Utility Documents

<u>Designation</u>	<u>Description</u>
SPL WW-146A	Manhole Seals, Plastic, Watertight
SPL WW-511	Lining System for Wastewater Manholes
SPL WW-511A	Structural Lining System for Wastewater Manholes
SPL WW-703	Adjusting (grade) rings for manhole chimney sections

City of Austin Standard

<u>Designation</u>	<u>Description</u>
506S-2	Major Manhole Height Adjustment

506S-4	Minor Manhole Height Adjustment
506S-15	Abandoned Manhole
506S-12	O-Ring Joint Detail, Precast Manhole Section
506S-13	Wedge Seal Joint Detail, Precast Manhole Section Adjustment
506S-15	Abandoned Manhole
804S-4, 5, 6 and 7 of 9	Steel Plating
<u>City of Austin Standard Contract</u>	
<u>Designation</u>	<u>Description</u>
00300U	Bid Form (Unit Prices)
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
ASTM C 55	Specification for Concrete Building Brick
ASTM C 62	Specification for Building Brick Solid Masonry Units Made from Clay or Shale
ASTM C478/C478M	Standard Specification for Precast Concrete Manhole
ASTM C443/C443M	Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C923/C923M	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures Pipes

ASTM C1107	Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D6132	Specification for Polyethylene Plastics Molding and Extrusion Materials
D4976	Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coating Over Concrete Using an Ultrasonic Gage
<u>American Concrete Institute</u>	
<u>Designation</u>	<u>Description</u>
Item 347	Guide to Formwork for Concrete

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 506, "Manholes"</u>	
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 2	Water and Wastewater Design Criteria
<u>City of Austin Standards</u>	
<u>Designation</u>	<u>Description</u>
1100S-1	Casting Adjustments
503S-4S	Storm Sewer Manhole Ring and 32" Cover

503S-4W	Sanitary Sewer Manhole Ring and 32" Cover
503S-5S	Bolted Storm Sewer Manhole Ring and 32" Cover
503S-5W	Watertight Manhole Ring and 32" Cover (W&WW)
506S-1	Manhole Invert Plan
506S-5	Typical Box Manhole 30" and Larger Pipe
506S-7	Precast Manhole with Drop Inlet on Cast in Place Foundation
506S-8	Precast Manhole with Drop Inlet on Precast Base
506S-9	Precast Manhole On Cast-In-Place Foundation
506S-10	Wastewater Manhole on Precast Base
506S-11	Storm Sewer Manhole Details
<u>American Association of State Highway and Transportation Officials (AASHTO)</u>	
<u>Designation</u>	<u>Description</u>
M306	Standard Specifications for Drainage Structure Castings

ITEM NO. 551 - PIPE UNDERDRAINS 5-16-97

551.1 - Description

This item shall consist of pipe underdrains embedded in filter material, constructed at such places as indicated and in accordance with lines and grades established by Engineer. This item shall also consist of any pumping, bailing, drainage and Item No. 509, "Trench Safety Systems" for trench walls, when indicated.

551.2 - Materials

(1) Pipe

The following materials will be permitted as alternates unless type is indicated. Size indicated shall be inside diameter. Pipe shall meet the following requirements:

Type 1 Vitrified Clay or Concrete Pipe

Pipe may be either thoroughly and perfectly burned or glazed vitrified clay or nonreinforced concrete conforming to ASTM C 14. Vitrified clay pipe shall be of first quality hub and spigot style, sound, without warps or cracks or other imperfections and shall be sufficiently tough so that it may be cut with a chisel and hammer.

Type 2 Clay Drain Tile

Standard clay drain tile shall conform to specifications of AASHTO M 179.

Type 3 Concrete Drain Tile

Butt end concrete drain tile shall conform to ASTM C 412. Tongue and groove concrete drain tile shall conform to ASTM C 118.

Type 4 Porous Concrete Pipe

Porous concrete pipe shall conform to AASHTO M 176.

Type 5 Perforated Clay Pipe

Perforated clay pipe shall conform to specifications for standard strength perforated clay pipe of AASHTO M 65 except that extra strength clay pipe may be substituted for standard strength clay pipe.

Type 6 Perforated Corrugated Metal Pipe

Perforated helically corrugated metal pipe shall be fabricated from corrugated galvanized sheets and shall conform to AASHTO M 36 or corrugated aluminum alloy sheets and shall comply with AASHTO M 196.

Type 7 Perforated Corrugated Metal Pipe (Bituminous Coated)

Pipe shall conform in all particulars to requirements specified above for perforated corrugated metal pipe. Steel pipe shall be uniformly coated inside and out with a bituminous coating to a minimum thickness of 0.05 inch.

Bituminous material used to coat pipe shall meet the following requirements when tested in accordance with TxDOT Test Method Tex-522-C:

Solubility, % by wt. in	
Trichloroethylene	99.5 minimum
Brittleness Test	Pass
Flow, inches	0.25 maximum

Type 8 Perforated Concrete Pipe

Perforated concrete pipe shall conform to ASTM C 444, "Standard Strength Perforated Nonreinforced Concrete Underdrain Pipe", except that "Extra Strength Perforated Nonreinforced Concrete Underdrain Pipe" may be substituted for standard strength pipe.

Type 9 ABS Perforated Pipe

ABS pipe shall be extruded and fittings molded from virgin ABS plastic material conforming to ASTM D 1788, Type 4, except that minimum heat deflection temperature is 180°F. Contractor shall furnish certified test reports as evidence that material used for project meets ASTM requirements. Dimensions of ABS pipe shall be as shown in Table I. Fittings shall conform to manufacturer's standard for particular size of pipe required.

TABLE I

Nominal Size, Inches	Inside Diameter Inches, Minimum	Thickness of Barrel Inches, Minimum
4	3.82	0.19
6	5.70	0.28

Perforations shall conform to requirements for Type 5 pipe underdrains. Crushing strength of ASB pipe shall meet or exceed minimum values in Table II when tested in accordance with flat-plate loading method as outlined in ASTM Designation: D 2412.

TABLE II

Nominal Size, Inch	Minimum Strength lb. Inch
4	179
6	604

Pipe shall withstand at least 35 percent vertical deflection without rupture of pipe wall and stiffness shall equal or exceed valves at 5 percent deflection. Vertical deflection shall be computed as follows:

$$\text{Percent Deflection} = \frac{\text{Reduction Vert. I.D.}}{\text{Nominal I.D.}} \times 100$$

Ends of ABS pipe, couplings and fittings shall be perpendicular or square to longitudinal axis of main body within a maximum angle of 3 degrees. Outer and inner surface of pipe shall be free from blisters, voids and discontinuities.

Type 10 Preformed Corrugated Polyethylene Plastic Tubing

Tubing shall comply with AASHTO M 252.

Type 11 Perforated Polyvinyl Chloride Pipe

Pipe shall be Schedule 40 and conform to ASTM D 1785. Unless otherwise specified, the perforated pipe shall have two rows of holes 13 mm (½ in.) in diameter on 125-mm (5 in.) centers, with allowable tolerances of ± 1 mm (1/16 in.) on the diameter and + 6, -0 mm (+¼, -0 in.) on the spacing, and the rows shall be parallel to the axis of the pipe and 120 ± 5° apart.

(2) Filter Material

(a) Aggregate

Filter material for use in backfilling trenches under, around and over underdrains shall consist of hard, durable, clean, washed gravel or crushed stone, ranging in size from 5/8 to 1 inch and shall be free from organic matter, clay balls or other deleterious matter.

(b) Geotextile

Geotextile shall conform to Item No. 620, "Filter Fabric".

551.3 - Construction Methods

Excavation of each trench shall begin at its outlet and proceed toward its upper end. Trench must not be excavated below proposed grade line and shall be located as indicated or as directed by Engineer and true to line and grade. Trench shall be dressed with a tile hoe or shovel in such manner that will facilitate placement of underdrain. Closed joints shall be coupled with bands, solvent weld couplings or integral joints. Perforated ABS pipe shall be jointed by couplers or solvent welding according to manufacturer's recommendation. No tar paper strips shall be used.

Approved plugs shall be placed in upper ends of pipes and exposed ends of underdrains shall be covered with ½ inch galvanized hardware cloth and filter fabric.

When indicated, concrete riprap or headwalls of dimensions indicated shall be constructed at outlet ends of pipe underdrains. Concrete materials and proportions shall conform to requirements specified for Class B Concrete conforming to Item No. 403, "Concrete for Structures".

When perforated metal pipe is used and trench is founded in pervious material, a thin layer of tamped impervious material shall be placed on bottom of trench as indicated or as directed by Engineer. Sections shall be jointed with band couplers.

When clay or concrete pipe is used and trench is founded in pervious material, a bottom course of specified filter material shall be placed and tamped to a uniform depth of 2 inches. Pipe shall then be firmly embedded in filter material, hub upgrade and spigot firmly centered into adjacent hub end or in the case of butt end type drains with an open joint of approximately 3/8 inch. Open joints shall then be covered with approved 2 ply tar paper strips not less than 6 inches in width and of sufficient length to permit ends being turned outward and laid flat on bottom course of filter material of each side for a distance of 3 inches. When trench is founded in impervious material, the 2 inch bottom course of filter material shall be omitted, pipe laid directly in trench and filter material placed in trench to a depth of 2 inches on each side of pipe. Two ply tar paper strips shall then be placed as specified above.

551.4 - Measurement

Work and accepted materials for "Pipe Underdrains" shall be measured by the linear foot of pipe measured along slope and shall include clearing, excavation, filter material, filter fabric, pipe, length of elbows, wyes, tees and other branches and backfill.

551.5 - Payment

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Pipe Underdrains" of type and size specified, which price shall be full compensation for furnishing and placing materials, for underdrain excavation and backfill, for filter materials, for plugs and screens and for labor, tools, equipment and incidentals necessary to complete the work.

Any riprap, headwalls or Trench Safety System indicated will be measured and paid for in accordance with provisions of Item No. 403, "Concrete for Structures", Item No. 410, "Concrete Structures", Item No. 509, "Trench Safety Systems" and Item No. 591, "Riprap for Slope Protection".

Payment will be made under:

Pay Item No. 551:	Pipe Underdrains, In.	Per Linear Foot.
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End

Ref: 403, 410, 509, 591, 620

ITEM NO. 593S - P.C. CONCRETE RETARDS 2-24-10**593S.1 - Description**

This item governs Portland Cement concrete retards used to anchor underground pipe. Retards shall be constructed as indicated on the Drawings, presented in City of Austin Standard Detail 593S-1 or as directed by the Engineer or designated representative in accordance with these specifications.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the SI units are given preference followed by inch-pound units shown within parentheses.

593S.2 - Submittals

The submittal requirements of this specification item include:

- A. Class D p.c. concrete mix design,
- B. Construction details (i.e. reinforcing steel, curing membrane).

593S.3 - Materials**A. Portland Cement Concrete**

The concrete materials used in construction under this item shall conform to Class D, Standard Specification Item No. 403, "Concrete for Structures".

B. Reinforcement

Reinforcement shall conform to Standard Specification Item No. 406, "Reinforcing Steel".

593S.4 - Construction Methods

Prior to placement of Portland cement concrete, excavation for retards shall be made to proper section and depth. If considered necessary by Engineer or designated representative, the bottom of the excavation shall be hand tamped and sprinkled. The excavated area for concrete retards shall be moist when the Portland cement concrete is placed.

After the Portland cement concrete has been placed, consolidated and shaped to conform to the dimensions indicated on the Drawings and after sufficiently set, it shall be given a moderately rough finish by floating with a wood float (Standard Specification Item No. 411S, "Surface Finishes for Concrete").

No mortar or concrete work shall be undertaken, when the ambient temperature is below 350F (10C) and Work shall be protected from freezing. After completion of the concrete retard, exposed surfaces shall be covered with burlap, cotton mats or other approved covering and kept moist for a minimum period of 3 days. White pigmented curing compound conforming to Item No. 409S, "Membrane Curing", Type 2, will be permitted when applied to exposed surfaces.

Unless directed otherwise by the Engineer or designated representative, the material excavated during trenching shall be disposed of at a permitted site.

593S.5 - Measurement

Concrete Retards will be measured either by the cubic yard per Drawing dimensions or on a unit basis complete in place.

593S.6 - Payment

Work performed and materials furnished as prescribed by this Standard Specification item, measured as provided under the "Measurement" section will be paid for by the cubic yard or the unit price bid for "Concrete Retards", as indicated in the Contract Documents. The bid pay item price shall include full compensation for excavation, reinforcing, furnishing, hauling and placing all materials required in the construction, the disposal of excavated material and any manipulation, labor, tools, equipment and incidentals necessary to complete the work.

This item shall also govern any pumping, bailing and dewatering or drainage necessary to complete the work when Concrete Retards are indicated on the Drawings or required by the Engineer or designated representative.

Payment will be made under one of the following:

Pay Item No. 593S-A:	Portland Cement Concrete Retards	Per Cubic Yard.
Pay Item No. 593S-B:	Portland Cement Concrete Retards	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 593S, "P.C. Concrete Retards"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures".
Item No. 406S	Reinforcing Steel".
Item No. 409S	Membrane Curing",
Item No. 411S	Surface Finishes for Concrete
Item No. 507S	Trench Safety Systems"

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 593S-1	Concrete Retard

RELATED CROSS REFERENCE MATERIALSSpecification Item No. 593S, "P.C. Concrete Retards"City of Austin Special Specifications

<u>Designation</u>	<u>Description</u>
Item No. 402S	Controlled Low Strength Material
Item No. 405 S	Concrete Admixtures
Item No. 407S	Fibrous Concrete
Item No. 501S	Jacking or Boring Pipe
Item No. 504S	Adjusting Structures
Item No. 505S	Concrete Encasement and Encasement Pipe

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 506S	Manholes
Item No. 507S	Bulkheads
Item No. 510	Pipe

Item No. 511S	Water Valves
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 421	Portland Cement Concrete
Item 440	Reinforcing Steel
Item 526	Membrane Curing
Item 532	Concrete Erosion Retards

ITEM NO. 628S - SEDIMENT CONTAINMENT DIKES 12-31-13**628S.1 - Description**

This item shall govern the provision and placement of temporary filtration dikes along or across such areas as indicated on the Drawings. This method shall be used during construction only and its purpose shall be to temporarily control erosion by intercepting and retaining sediment.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

628S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Locations and Types of containment dikes (hay Bales or Triangular Sediment Filter Dike).
- B. Seeding
 - 1. Identification of the type, source, mixture, pure live seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer.

628S.3 - Materials**A. Hay Bales**

"Hay Bales" shall be free of Johnson Grass or other noxious weeds. The bales shall consist of either hay or straw in good condition and be securely tied with wire. Stakes for anchoring bales shall be #4 (10M) reinforcing bars, ½ inch (12.5 mm) steel pickets or 2 x 2 inch (50 x 50 mm) wooden stakes. Hay bales shall be limited to drainage areas less than 2,500 square feet (0.02 hectares).

B. Filter Dike

"Filter Dike" shall be prefabricated from 6x6-D2.9xD2.9 (150x150-MW19xMW19) WWF and 4.5 oz. (127 grams) non-woven polyester filter fabric securely fastened to WWF with galvanized shoat rings or j-clips. A 12-inch (300-mm) skirt shall be a continuous extension of the filter fabric on the upstream face.

The filter fabric shall extend beyond the dike joints to provide a 3-inch (75-mm) overlap. Ends of dike not lapped with filter fabric shall be plugged with filter fabric.

628S.4 - Construction Methods

The Contractor may select the material for the dikes, unless otherwise indicated, conforming to the details on the Drawings and Standard Detail Numbers 628S and 628S-1.

Bales shall be placed with ends tightly abutting the adjacent bales. Each bale shall be embedded in the soil a minimum of 4 inches (100 mm) and a maximum of 6 inches (150 mm). Bales shall be securely anchored in place by a minimum of 2 stakes per bale. The first stake in each bale shall be angled toward the previously placed bale to force the bales together. Stakes shall be embedded in the soil a minimum of 1 ½ feet (0.45 meters). Bales that are not able to be imbedded and are placed on impervious cover should be placed level with the concrete and have all bales butted end to end with no voids or gaps

between them. Bales shall be bound by either wire or nylon string. Bales shall be replaced every 2 months or more often during wet periods.

For filter dikes the filters shall be placed with ends tightly abutting the adjacent filter. Each filter and skirt shall be securely anchored in place using 6 inch (150 mm) staples at a maximum spacing of 12 inches (300 mm) on center. Anchoring on impervious areas shall be accomplished with sand/gravel bags placed at 18 inches (450 mm) on center or with a nominal 1 inch by 4 inch (25 mm by 100 mm) board nailed at 18 inches (450 mm) on center.

Silt accumulation behind hay bales and triangular sediment filter dikes shall be removed at a maximum depth of 6 inches (150 mm) or when, in the opinion of the Engineer or designated representative, the structure ceases to function as intended.

All dikes shall be inspected by the Contractor at least monthly and after each rainfall. Dikes shall be repaired or replaced when necessary or as directed by the Engineer or designated representative.

After completion of construction or when directed by the Engineer or designated representative the dike shall be removed and the site re-graded to the final grades. Any depression shall be filled and any accumulations of silt shall be spread or removed to a permitted disposal area. After removal of the dike the area shall be graded and seeded conforming to Item No. 604S, "Seeding for Erosion Control".

628S.5 - Measurement

The work performed and the materials furnished as prescribed by this item will be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) of "Sediment Containment Dikes", complete in place.

628S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Sediment Containment Dikes" indicated on the Drawings. The Unit bid price shall include full compensation for: (a) furnishing, hauling and placing all materials including all labor, tools, equipment and incidentals needed to complete the work, (b) the repair and/or replacement of materials, (c) the removal and disposal of all silt and debris and (d) the removal of all dikes, silt and debris after completion of construction or when directed by the Engineer or designated representative.

When indicated on the Drawings, payment for sediment containment will be made under:

Pay Item No. 628S-A:	Sediment Containment Dikes with hay bales	Per Lineal Foot.
Pay Item No. 628S-B:	Sediment Containment Dikes with filter fabric	Per Lineal Foot.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>
<u>Specification 628S, "Sediment Containment Dike"</u>

<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 628S	Triangular Sediment Filter Dike
Number 628S-1	Hay Bale Dike
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 604S	Seeding for Erosion Control
<u>City of Austin Standard Contract</u>	
<u>Section</u>	<u>Description</u>
00300U	Bid Form (Unit Prices)

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 628S, "Sediment Containment Dike"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way

Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401S	Structural Excavation and Backfill
Item No. 406S	Reinforcing Steel
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer

SEDIMENT CONTAINMENT DIKESItem No. 628S

Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 632S - STORM INLET SEDIMENT TRAP 11-26-01**632S.1 - Description**

This item governs the construction of a temporary silt basin around a drainage structure, the maintenance of the trap, the removal of silt accumulations until the trap is no longer required, the restoration of the area to the final grade and the re-vegetation of the disturbed area.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

632S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Locations and Types of inlet traps (yard or curb drain).
- B. Seeding
 - 1. Identification of the type, source, mixture, pure Live Seed (PLS) and rate of application,
 - 2. Type of mulch,
 - 3. Type of tacking agent, and
 - 4. Type and rate of application of fertilizer.

632S.3 - Materials

- A. Seeding

Seeding for re-vegetation shall conform to Standard Specification Item No. 604S, "Seeding for Erosion Control".
- B. Embankment

Embankment shall conform to Standard Specification Item No. 132S, "Embankment".

632S.4 - Construction Methods

The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root material in conformance with Standard Specification Item 102S, "Clearing and Grubbing".

Construction operations shall be carried out in such a manner that erosion and water pollution shall be minimized.

Sediment shall be removed and the trap shall be restored to its original dimensions when the sediment has accumulated to $\frac{1}{2}$ the design depth of the trap. The sediment, that is removed, shall be deposited in an approved area and in such a manner that it will not erode.

The structure shall be inspected monthly and after each rain and repairs made as needed by the Contractor throughout the duration of this contract or until the Engineer or designated representative provides written permission to remove the structure.

When the trap is no longer required, the Contractor shall remove the silt accumulation and backfill the trap in accordance with Standard Specification Item No. 130S, "Borrow" or Standard Specification Item No. 132S, "Embankment". Any material placed shall be compacted in 8-inch (200 mm) lifts, loose measure and compacted to the required density by mechanical means.

The temporary Storm Inlet Sediment Trap shall be removed, when directed by the Engineer or designated representative, and the area leveled off and protected by erosion control measures appropriate for the terrain as indicated on the Drawings and/or Standard Detail Number 632S-1, "Storm Inlet Sediment Trap". Permanent Storm Inlet Sediment Traps shall be seeded and comply with all the requirements for Item No. 604S, "Seeding for Erosion Control".

632S.5 - Measurement

Acceptable work performed as prescribed by this item will be measured by the cubic foot (cubic meter: 1 cubic meter equals 35.31 cubic feet) of sediment trap complete in place.

632S.6 - Payment

The Work performed and the materials furnished for this item as provided under "Measurement" will be paid for at the unit bid price per cubic foot of sediment trap constructed. The Unit Bid Price shall include full compensation for: (a) furnishing, hauling and placing all materials including all labor, tools, equipment and the incidentals needed to complete the work, (b) maintaining the trap, (c) removing any silt accumulations, (d) removing, regrading and disposing of all silt and debris, (e) regrading and placing embankment and (f) re-vegetation of area upon removal of the trap.

Payment will be made under:

Pay Item No. 632S:	Storm Inlet Sediment Trap	Per Cubic Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 632S, "Storm Inlet Sediment Trap"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 632S-1	Storm Inlet Sediment Trap
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

Item No. 102S	Clearing and Grubbing
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 604S	Seeding for Erosion Control

RELATED CROSS REFERENCE MATERIALS**Specification 632S, "Storm Inlet Sediment Trap"****City of Austin Standard Specifications**

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 634S - LEVEL SPREADER 6-21-07**634S.1 - Description**

This item governs furnishing and installing an entrance channel conversion to sheet flow without causing erosion to the existing vegetation. This item shall include the re-vegetation of the area.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

634S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. The source, material type and classification, density and moisture requirements of the embankment materials
- B. The soil retention blanket material type and sample, evidence that the material is listed on TxDOT/TTI's Approved Products List, one (1) full set of Manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.
- C. Re-vegetation program, including:
 - 1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer.

634S.3 - Materials

- A. Filter Fabric
Filter Fabric shall conform to Item No. 620S, "Filter Fabric".
- B. Backfill
Fill shall conform to Item No. 132S, "Embankment".

634S.4 - Construction Methods

Level Spreader shall be constructed level to insure uniform spreading of sediment-free runoff. The Level Spreader shall be constructed on undisturbed soil. A filter fabric erosion stop shall be placed vertically at least 6 inches (150 mm) deep in a silt trench 1 foot (300 mm) back from the level lip and parallel to the lip. The entire level lip area shall be protected by 2 strips of "Soil Retention Blanket" (Standard Specification Item 605S). The entrance channel shall not exceed a 1 percent grade before extending the spreader. All groundcover shall be re-established and construction areas stabilized.

The structure shall be inspected monthly and after each rainfall. Repairs shall be made by the Contractor, as needed, throughout the duration of the contract or until the Engineer or designated representative provides written permission to remove the structure.

634S.5 - Measurement

Measurement of the Level Spreader as prescribed by this item will be by the square foot (square meters: 1 square meter equals 10.764 square feet) of the bottom channel.

634S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Level Spreader". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating of existing fencing, removal of silt and removal and disposal of all materials at the completion of construction and re-vegetation of disturbed areas.

Payment will be made under:

Pay Item No. 634S:	Level Spreader	Per Square Foot of Bottom Channel.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 634S, "Level Spreader"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 634S-1	Level Spreader
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 132S	Embankment
Item No. 605S	Soil Retention Blanket
Item No. 620S	Filter Fabric

RELATED CROSS REFERENCE MATERIALS**Specification 634S, "Level Spreader"****City of Austin Standard Specifications**

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation

Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 640S - MORTARED ROCK WALL 2-24-10**640S.1 - Description**

This item shall govern the construction of mortared rock walls, as herein specified, on a prepared subgrade, including furnishing the stone, mortar and other related materials to construct walls, the excavation and backfilling the wall, removal of any old structure or portions thereof encountered, disposal of surplus excavated material and the completion Mortared Rock Walls as indicated on the Drawings or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

640S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Details concerning the p.c. concrete footing including dimensions of the footing, the p.c. concrete mix design, steel reinforcement, etc.
- B. Source, type and gradation of rock
- C. Mortar mix design.

640S.3 - Materials**A. Rock:**

All types used shall be native limestone suitable for horizontal course type construction. The size of rock to be used for construction shall be as indicated on the Drawings, but may vary as approved by the Engineer or designated representative.

B. Portland Cement: ASTM C 150, Type I**C. Masonry Cement: ASTM C 91****D. Sand: ASTM C 144, Natural****E. Water: Free from matter that could impair suitability for use in mortar****F. Hydrated Lime: ASTM C 207, Type S****G. Mortar:**

Mortar shall be composed of 1 part Portland Cement, 1 part hydrated lime and 6 parts sand (by volume) and water. Mortar shall have a consistency that insures that it can be easily spread by a trowel. An alternate mix composed of 1 part masonry cement and 3 parts sand may be used. The sand shall be measured damp and loose.

640S.4 - Construction Methods

Stone shall be laid plumb, level or true to a line. All stone shall be laid in a full bed of mortar with head joints and edge joints completely filled. The face shall be aligned or exposed as indicated on the Drawings. Exterior joints that will remain exposed shall be finished in a manner approved by the Engineer or designated representative.

In hot weather, stone work shall be kept moist until the mortar has set. No mortar work will be done when the temperature is below 40°F (4°C) in the shade and all work may be suspended during freezing or undesirable weather. The mortar materials shall be mixed mechanically for not less than 5 minutes after

all ingredients are in the mixer. Mortar that has begun to set or that has been mixed for more than 2 hours shall not be used.

Spalls may be used in partially filling the large voids, provided they are keyed in properly and are well coated with mortar. All finished rockwork shall be protected from damage. Chipped rockwork, that will remain exposed, shall be satisfactorily repaired or replaced.

Mortared rock walls shall consist of courses or layers of rock with the spaces between them filled with mortar and shall be constructed at such places as indicated on the Drawings or as directed by the Engineer or designated representative, in accordance with these specifications and in conformity with the lines, grades, height, depth and other details shown on the pertinent typical sections.

Excavation and concrete footings for mortared rock walls shall not be paid for directly, but shall be included in the unit price bid for mortared rock wall construction.

Prior to placing any material, the footings shall have been placed by the Contractor as part of this contract to the approved line and grade and allowed at least 36 hours curing time. The rock shall then be thoroughly wet and bedded in 1 inch (25 mm) of mortar placed on the footings, one against the other, with the resulting voids being completely filled with mortar. The finished surface shall be even and level.

640S.5 - Measurement

Mortared rock wall will be measured by the square foot (square meter: 1 square meter equals 10.76 square feet) of the outside, vertical face of wall. No measurement will be made for concrete footing and shall be included in the unit price bid for the rock wall construction.

640S.6 - Payment

Mortared rock wall acceptably completed will be paid for at the contract unit bid price per square foot. The unit bid price shall include full compensation for furnishing all materials, for excavation, and backfill, for all forming, transporting, placing, finishing and for all equipment, tools, labor and incidentals necessary to place mortared rock wall on concrete footing as specified and indicated on the Drawings.

Payment will be made under:

Pay Item No. 640S:	Mortared Rock Wall	Per Square Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 640S, "Mortared Rock Wall"</u>	
<u>American Society for Testing and Materials, ASTM</u>	

<u>Designation</u>	<u>Description</u>
C 91	Specification for Masonry Cement
C 144	Specification for Aggregate for Masonry
C 150	Specification for Portland Cement
C 207	Specification for Hydrated Lime for Masonry

RELATED CROSS REFERENCE MATERIALSSpecification 640S, "Mortared Rock Wall"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 403S	Concrete for Structures
Item No. 405	Concrete Admixtures
Item No. 406	Reinforcing Steel
Item No. 606S	Fertilizer
Item No. 608S	Planting

Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work

ITEM NO. 660S - BIOFILTRATION MEDIUM 1-4-16

660S.1 - Description

This item shall govern mixing and placing medium for a biofiltration basin intended to treat storm runoff. This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

(1) Submittals

The submittal requirements of this specification item include:

A. A signed statement provided by the Contractor that:

1. A laboratory analysis has been conducted by of the actual mixture being proposed, and has been verified as meeting the specifications below. The date of the laboratory analysis must be no more than six months prior to the date of installation of the biofiltration medium. A copy of the laboratory results must be provided.
2. No "sandy loam" fill material (aka "red death") is included in the mixture.
3. Report the source of organic matter.

B. Laboratory reports of analyses results documenting that the mixture meets the following specifications:

1. Particle size distribution performed per ASTM D-422:

- Coarse fragments + sand content of 70 - 90% by weight

- Clay content of 3 - 10% by weight

- Silt + clay content \leq 27% by weight

2. Percent organic matter of 0.5 - 5% by weight per ASTM D2974 Method C

C. Contractor's statement that the biofiltration medium has been tested by a laboratory using approved procedures (copy of lab results provided below) and meets the criteria as noted in Table 1 below:

Table 1 - Biofiltration Medium Characteristics

Parameter	Results*	Criteria	Criteria Met?*
Percent Sand + Coarse Fragments (ASTMD-422)		70 - 90%	
Percent Clay (< 0.002 mm)		3 - 10%	
Percent Silt + Clay (< 0.05 mm)		\leq 27%	

Percent Organic Matter (ASTM D-2974)		0.5 - 5%	
Is any "Red Death" included in medium?		None allowed	
Is the mixture free of trash, stones, weeds, or other undesirable material?		None allowed	
Is the medium well-mixed and homogenous?		Must be homogenous	

* Laboratory Must Fill In These Cells

Table 2 - Biofiltration Medium Testing and Installation Dates

Date of Laboratory Analysis (earliest)*	
Date of Medium Installation*	
Time between Dates (months)*	
Criteria for Time Between Dates (months)	6
Is Criteria Met?*	

* Contractor Must Fill In These Cells

Source: [Rule No. R161-15.14, 1-4-2016](#) .

660S.2 - Materials

(1) Acceptable Materials

The following mixture (% by volume) should create an appropriate biofiltration medium, subject to specific characteristics of the topsoil, which may exhibit considerable variability:

- 70-80% concrete sand per ASTM C33 and/or screened decomposed granite sand
- 20-30% screened bulk topsoil (chocolate loam is also acceptable)

- The source materials must be free of stones, roots, or other similar objects larger than two inches. Additionally, it should be free of trash, other undesirable material, and should not contain weeds or weed seeds.
- The ingredients shall be well-mixed to create a homogenous medium.

(2) Unacceptable Materials

A commercially available fill material that should not be used is typically marketed as "sandy loam." This product is often referred to by landscapers as "red death", which refers to the color of the material, and is an infertile fill material that has poor drainage characteristics. All materials shall be free of Bermuda grass, Quackgrass, Johnson grass, or other noxious weeds, their roots or seeds.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.3 - Construction Methods

(1) Erosion Control

Prior to commencing this work, all required erosion control and environmental measures shall be in place as indicated on the approved site plan and/or modified.

(2) Scheduling, Delivery, Storage and Signage

The biofiltration medium must be delivered to, or mixed at, the site prior to the mid-construction conference. The medium must be certified as meeting the required specifications by the project Engineer, and approved by the City Inspector. The medium must be stored on-site separate from other materials, and covered to prevent erosion of the mixture by rainfall and runoff. The medium must have a prominent tag affixed that reads "BIOFILTRATION MEDIUM FOR WATER QUALITY POND."

(3) Placement

Complete construction and stabilize all areas draining to the biofiltration basin. Permanent controls will be cleaned out and filter medium will be installed after stabilization of the site. Install geotextile fabric per the Biofiltration Bed detail provided in Standard Detail 661-3. Biofiltration medium shall be placed in lifts of 12 to 18 inches without using heavy operating equipment or compaction. Lifts should be lightly watered to encourage soil settling. The final surface must be raked flat. The project Engineer must be notified 24 hours prior to installation of the biofiltration medium and approve and certify the installation.

(4) Shrinkage

Some shrinkage of the medium is to be expected after installation, in the range of 5-15%. As a general recommendation about 20 inches of medium should be installed to achieve a depth of 18 inches.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.4 - Measurement

Biofiltration medium will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) in its final position based upon the average end areas, calculated from pre-construction

cross sections and plan grades. The plan quantities for biofiltration medium will be used as the measurement for payment of this item.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.5 - Payment

All work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering on the road; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

Payment will be made under the following:

Pay Item No. 660S:	Biofiltration Medium.	Per Cubic Yard.
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END OF SECTION

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Biofiltration Medium</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.6.7.C	Biofiltration

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Biofiltration Medium</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>

Section 1.6.5.A.4	Sand Filtration Basin Details
City of Austin Standards Details	
Designation	Description
Item No. 661-3	Biofiltration Bed Configurations Using Geomembrane/Clay Liner
City of Austin Standard Specifications	
Designation	Description
Item No. 620S	Filter Fabric

ITEM NO. 661S - SOIL DECOMPACTION 11-14-16

661S.1 - Description

This work shall consist of performing all required activities for soil decompaction in areas shown on the Drawings or as directed by the Engineer, Landscape Architect, or authorized City of Austin representative. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with Soil Decompaction, complete as shown on the drawings and as specified herein.

A. The scope of work in this section includes, but is not limited to, the following:

1. Modify existing site soil.
 - a. Modify existing in-situ site soil in place for use as Planting Soil.
 - b. Install existing or modified existing stockpiled soil for use as Planting Soil.
2. Install compost and/or other amendments into existing site soil as part of decompaction.
3. Clean up and disposal of all excess and surplus material.

B. Definitions

1. Air tillage, fertilizer, mulch (AFM), as coined by Fite, Smiley, McIntyre & Wells (2011 ⁱ[14](#)), is a soil decompaction and amendment process for trees involving decompaction with a pneumatic air tool while simultaneously incorporating organic matter and fertilizer into the soil.
2. **A horizon:** Mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material.
3. **Bulk Density Method:** A method for measuring soil compaction where bulk density is an indicator of compaction, calculated as the dry weight of soil divided by its volume. Bulk density reflects a soil's ability to function for structural support, water and solute movement, and soil aeration. Threshold results that determine critical bulk density are different for each soil texture. Typical measurement is done with bulk density cores, and the units are in lb./cf or g/cc ³ dry weight.
4. **Compacted soil:** High density soil lacking structure and porosity and characterized by restricted water infiltration and percolation (drainage), and limited root penetration.
5. **Critical Root Zone (CRZ):** The amount of ground around a tree protected from impacts by the City ordinance. This is defined as a radius around the tree trunk equal to one (1) foot of ground for every one (1) inch of tree trunk diameter when measured four-and-a-half (4.5) feet above the ground (DBH). This area is depicted in the plan as a circle centered on the location of the tree's base.
6. **Diameter Breast Height (DBH):** Tree diameter measured at breast height, defined as 4.5 feet above average ground level. **Field Capacity:** The amount of water held in the soil after drainage due to the force of gravity. The volumetric soil moisture content remaining at field capacity is about 15 - 20% for sandy soils, 35 - 45% for loam soils, and 45 - 55% for clay soils.
7. **Graded soil:** Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than twelve (12) inches.
8. **Penetration Resistance Method:** A method for measuring soil compaction based on penetrometry, or soil strength, measuring the resistance of soil surface to vertical force by inserting a rod or penetrometer into the soil. Threshold results that determine critical bulk density are somewhat the same for each soil texture. The typical measurement tool is a penetrometer, and the units are PSI (pounds of pressure per square inch).

9. Permanent Wilting Point: Water content of a soil when most plants growing in that soil wilt and fail to recover their turgor upon rewetting.

Table 661S.1 Wilting Point and Field Capacity by Soil Type

Soil type	Permanent wilt point v/v	Field capacity v/v
Sand, Loamy sand, Sandy loam	5 - 8%	12 - 18%
Loam, Sandy clay, Sandy clay loam	14 - 25%	27 - 36%
Clay loam, Silt loam	11 - 22%	31 - 36%
Silty clay, Silty clay loam	22 - 27%	38 - 41%

Volumetric soil moisture shall be measured with a digital, electric conductivity meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent meter.

Source: 015639 Tree and Plant Protection Specification (www.isa-arbor.com)

10. Planting Soil: Approved topsoil and topsoil mix as defined in Standard Specification 601S.
11. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top.
12. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel through the soil to the depths and spacing specified.
13. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, or spade tiller.
14. Solvita compost maturity test: A patented environmental measurement system for carbon dioxide and ammonia, the results of which can be used to assess soil health (biology), compost maturity, ammonia volatilization in manure, or grain spoilage due to fungal respiration.
15. Standard Proctor Method ASTM D 698: A method for measuring soil compaction, determining the optimal moisture content at which a given soil type will become most dense, achieving its maximum dry density. Threshold results that determine critical bulk density are the same for each soil texture. A proctor test will typically also provide results as bulk density lb/cf dry weight. Typical measurement tool is a densitometer, and the units are percentage maximum dry bulk density as tested by the standard proctor method.
16. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
17. Subsoiling: A soil decompaction method that fractures compacted soil without adversely disturbing plants or topsoil.
18. Surface Soil Compaction: A maximum of six (6) inches deep and the result of traffic, light grading, or other impacts. The original A horizon may have been previously removed or graded

but the lower profile is intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plant and may need to be modified.

19. Subsoil or Deep Soil Compaction: Deeper than six (6) inches, and may be the result of previous grading, filling and dynamic or static compaction forces.
20. Topsoil: Naturally produced and harvested soil from the A horizon or upper layers or the soil.
21. Vertical Mulching: A soil decompaction method for tree root zones involving drilling or air spading a series of shallow holes in the root zone and filling them with compost or other materials.
22. Undisturbed, ungraded soil: Soils with the original A horizon intact that have not been graded or compacted. Examples of undisturbed soils are those that have been farmed by no-till methods; those subjected to fire or logged but not graded; and natural forested land.

Source: [Rule No. R161-16.21, 11-14-16](#).

Footnotes:

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Fite, K., E. Thomas Smiley, J. McIntyre, & C.E. Wells. 2011. Evaluation of a Soil Decompaction and Amendment Process for Urban Trees. *Arboriculture & Urban Forestry* 37(6).

661S.2 - Submittals

The submittal requirements of this specification item shall include the test results, information about proposed equipment, and samples necessary for approval of decompaction techniques and methods.

- A. Soil compaction testing shall be performed both before and after modification of soil, unless otherwise specified by the Engineer or Landscape Architect.
 1. Soil compaction testing shall include written results and mapped locations of tests provided to the Owner. A minimum of two tests per 1,000 square feet are required. Test results shall be reported in PSI or bulk density (g/cm³) unless otherwise specified by the Engineer or Landscape Architect. For surface decompaction, measure at both the surface and at six (6) inches depth. For subsurface decompaction, measure at both six (6) inches depth and three-quarters of the maximum depth of decompaction. For example, if maximum depth of desired decompaction is 15 inches, measure at both 6 inches and 11 inches below finished grade.
- B. Provide written information on type and size of equipment proposed to produce the desired decompaction.
- C. For any required compost and mulch, provide a one gallon sample of the material with a lab analysis supplied by the producer to the inspector showing that the product(s) meets the requirements. Lab analyses for compost shall be no older than ninety (90) calendar days at the time of submittal.
 1. Submit samples a minimum of two (2) weeks before the anticipated date of the start of the compost installation.
 2. Samples shall be submitted at the same time as the lab analysis of the material.
 3. Producer shall provide a letter stating the length of the composting period for compost, and listing the source materials by volume for compost and mulch.
- D. For decompaction work under trees, provide qualified arborist credentials, including proof of certification from the International Society of Arboriculture, licenses, resume and/or references.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.3 - Materials

The Contractor shall be responsible for supplying all supplies and equipment in sufficient quantities so as to perform soil decompaction as necessary without delaying construction progress.

A. Compost: Blended and ground leaf, wood and other plant based material, composted for a minimum of nine (9) months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plants or other materials designed to produce compost high in fungal material. Non-vegetal source materials may be acceptable upon approval by the Owner. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.

1. Compost shall be commercially prepared compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".

http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf

2. Compost shall comply with the following parameters:

PARAMETERS ¹	REPORTED AS (UNITS OF MEASURE)	GENERAL RANGE
pH	pH units	6.0 - 8.5
Soil Salt (electric conductivity)	dS/m (mmhos/cm)	Maximum 10
Moisture Content	%, net weight basis	30 - 60%
Organic Matter Content	%, dry weight basis	30 - 65%
Particle Size	% passing a selected mesh size, dry weight basis	98% pass through ¾ inch screen
Stability Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day	<8
Solvita Compost Maturity Test	Solvita units	>6
Physical Contaminants (inerts)	%, dry weight basis	<1%

Chemical Contaminants ²	mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels
Biological Contaminants Select pathogens Fecal coliform bacteria or Salmonella ³	MPN per gram per dry weight MPN per 4 grams per dry weight	Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

¹ Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council).

² US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels = Arsenic 41 ppm, Cadmium 39 ppm, Copper 1,500 ppm, Lead 300 ppm, Mercury 17 ppm, Molybdenum 75 ppm, Nickel 420 ppm, Selenium 100 ppm, Zinc 2,800 ppm.

³ US EPA Class A standard, 40 CFR § 503.32(a) levels = Salmonella <3 MPN/4grams of total solids or Fecal Coliform <1000 MPN/gram of total solids.

- B. Mulch (hardwood): Mulch shall be coarse-ground and derived from hardwood (e.g., oak, elm) trees and woody brush sources. No more than 25% of the total volume shall be fine particles and no more than 20% of total volume shall be large pieces, where fine particles are defined as less than 3/8 inch in size and large pieces are defined as either larger than 1½ inch in diameter or longer than eight (8) inches. The mulch shall be free from foreign materials.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.4 - Construction Methods

- A. General. Before initiation of decompaction activities, all required erosion control and environmental measures shall be in place as indicated on the drawings, and the depth(s) and location(s) of underground utilities shall be verified. The surface of the subgrade shall be shaped in general conformity with the typical sections, lines, and grades indicated on the drawings by the removal of existing material or by the addition of approved material as established by the Engineer or Landscape Architect.

This specification covers decompaction of (1) surface soils (0 - 6 inches) and/or (2) subsoil (below 7 inches) as show on the drawings. Requirements for decompaction of soils within the critical root zones of existing trees are also described.

- B. The following are general threshold levels of compaction as determined by three compaction testing methods, including the bulk density method, standard proctor method, and penetration resistance method. The penetration resistance values were derived from the measurement of reference and degraded riparian sites across Austin, Texas studied in the Watershed Protection Department's Riparian Functional Assessment project.

Compaction levels that are detrimental to root growth are dependent on soil type, which typically varies from site to site and must be determined by an Engineer or Landscape Architect before testing occurs.

Excellent to Good Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.

Fair Compaction: Root growth is limited with fewer, shorter and slower growing roots.

Poor Compaction: Roots not likely to grow but may penetrate soil when soil is above field capacity.

Table 661S.4.1 Comparison of Compaction limits by various methods.

COMPACTION RATING	BULK DENSITY ¹ (g/cm ³)	STANDARD PROCTOR (%)	PENETRATION RESISTANCE (PSI) ²
Excellent	<1.10 to	75 - 85%	75 - 125 ³
Good	<1.60		126 - 175
Fair	1.39 to 1.69	>85%	176 - 225
Poor	>1.47 to >1.80		>225

¹ Root limiting bulk density varies by soil type. See Table SS-661.4.2 for specifics.

² Acceptable test methods include ASTM D3441 Standard Test Method for Mechanical Cone Penetration or methods described in references such as Methods for Soil Analysis, Part 1, Physical and Mineralogical Methods, 2nd ed., EA Klute, ed. (Soil Science Society of America: Madison, WI 1986).

³ Penetration resistance method: Below 75 psi soil becomes increasingly unstable and will settle excessively.

Table 661S.4.2 Comparison of Root Limiting Bulk Density for Different Soil Types. Source: NRCS 1998 in Dallas and Lewandowski (2003).

Soil texture	Ideal bulk densities (g/cm ³)	Bulk densities that may affect root growth (g/cm ³)	Bulk densities that restrict root growth (g/cm ³)
Sands, loamy sands	<1.60	1.69	>1.80
Sandy loams, loams	<1.40	1.63	>1.80
Sandy clay loams, loams, clay loams	<1.40		>1.75

Silts, silt loams	<1.30	1.60	>1.75
Silt loams, silty clay loams	<1.10	1.55	>1.65
Sandy clays, silty clays, some clay loams (35 - 45% clay)	<1.10	1.49	>1.58
Clays (>45% clay)	<1.10	1.39	>1.47

- C. All soil management activities including amendment and/or decompaction must occur at a soil moisture content between 5 - 20% measured at the depth of the work.
- D. Compacted Surface Soil (**0 - 6 inches**) : Tilling. Surface tilling shall not be considered adequate to reduce compaction at depths seven (7) inches or greater below finished grade.
1. After rough grading and removing all plants and debris from the surface, till top six (6) inches with a roto tiller, spade tiller, or other equipment approved by the Engineer or Landscape Architect. Spread three (3) inches of compost on the surface of the tilled soil.
 2. Till the compost into the loosened soil. Smooth out grades with a drag rake or drag slip. An even bed, with limited irregularities, lumps or soil clods shall be prepared. Clods or rocks larger than two (2) inches shall be removed.
- E. Compacted Subsoil (**7 - 24 inches**) : Soil Ripping
1. After rough grading and removing all plants and debris from the surface, loosen the soil by dragging a ripping shank or chisel through the soil to depths of twenty-four (24) inches maximum. The Engineer or Landscape Architect shall specify the appropriate depth of ripping based on site conditions. Shank spacing varies with soil moisture, soil type, and degree and depth of compaction. Shank spacing shall be as specified by the Engineer or Landscape Architect.
 2. At least three (3) separate series or patterns of movement are required.
 - (1) The first series or pattern of passes is applied lengthwise, parallel with the longest spread of the site; gradually progressing across the site's width, with each successive pass.
 - (2) The second series runs obliquely, crossing the first series at an angle of about 45 degrees.
 - (3) The third series runs at right angle or 90 degrees to the first series.
 3. Spread three (3) inches of compost or other specified amendment over the ripped area and till the material into the top six (6) inches of the soil surface using a roto-tiller or other approved method. An even bed, with limited irregularities, lumps or soil clods shall be prepared. Clods or rocks larger than 2" shall be removed.
- F. Compacted Subsoil (**7 - 24 inches**) : Subsoiling.
1. Drag a ripping shank or chisel thru the soil to depths of twenty-four (24) inches maximum. The Engineer or Landscape Architect shall specify the appropriate depth of ripping based on site conditions. Shank spacing varies with soil moisture, soil type, and degree and depth of compaction. Shank spacing shall be as specified by the Engineer or Landscape Architect. Do not disturb soil or plants in the areas between subsoiled trenches.

2. Fill subsoiled trenches with compost to create a uniform surface grade.

G. Compacted Soil within the critical root zone of existing established trees: Full AFM or Vertical Mulching.

Two techniques are described based on tree location relative to the floodplain and potential for adverse erosion. An International Society of Arboriculture (ISA) certified arborist should oversee work under trees at all times.

Under no circumstances should decompaction work be done in the one-quarter ($\frac{1}{4}$) critical root zone.

1. Remove the tops of all plants to be removed from the root zone. Remove sod with a walk behind sod cutter. Do not grub out the roots of plants to be removed.
2. Prior to beginning work, the proposed area shall be sufficiently wetted twenty-four (24) hours in advance to minimize dust to the greatest extent possible.
3. Use a pneumatic air tool such as an air knife or air spade.
4. Method 1 - Full AFM: In a location outside the floodplain and on slopes of 3:1 or less, use a pneumatic air tool to loosen the top nine (9) to twelve (12) inches of the soil in the entire dripline. In cases where nine (9) to twelve (12) inches is not attainable (i.e., shallow soil), apply aeration to the depth of soil present. Surface roots may move and separate from soil during this process but the bark on roots should not be broken. Make chemical adjustment as recommended by the soil test and as recommended by an ISA arborist or Landscape Architect. Any fertilizer treatment should be per a certified arborist. Add three (3) inches of compost over the soil immediately after aeration. Use a pneumatic air tool to mix the compost into the top six (6) to eight (8) inches of the loosened soil. Apply a minimum of three (3) inches of shredded hardwood mulch across the entire treatment area, but kept back one (1) foot from the trunk.
5. Method 2 - Vertical Mulching: This technique is suitable for a floodplain or other location subject to adverse erosion. Use a pneumatic air tool to make one (1) inch minimum diameter holes to a depth of ten (10) to twelve (12) inches with holes three (3) feet on center from the half critical root zone (CRZ) to the dripline. Funnel compost into the holes. Apply three (3) inches of shredded hardwood mulch across the entire treatment area, but kept back one (1) foot from the trunk.
6. Work in sections such that the entire process - including any proposed irrigation - can be completed in one day for each section. Apply ten (10) gallons of water per inch in diameter of DBH over the loosened soil at the completion of each day's work except during precipitation events of half inch or greater. During drought or other prolonged dry periods, continue to provide supplemental water for one (1) to three (3) weeks minimum after treatment.
7. Decompacted tree root zones should be access-restricted for one year using aluminum posts and chain barriers, at minimum, or approved equal. The barriers shall be erected at the edge of the decompacted zones around an entire tree or tree cluster, per the plans, without driving posts into major roots (3-inches diameter or greater).

H. Protection of Decompacted Soils: After any decompaction activities have taken place do not pass motorized equipment or stockpile construction materials or equipment on previously decompacted soil.

The Contractor shall protect decompacted soil from damage including contamination and re-compaction due to other soil installation, planting operations, and operations by other Contractors. Maintain protection of decompacted areas until project acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged decompacted soil immediately.

I. Repair of Re-compacted Soils: After decompaction has taken place, any soil that becomes re-compacted to a density greater than 225 psi shall be decompacted again.

1. Loosen compacted soil and replace soil that has become contaminated as determined by the Engineer or Landscape Architect. Re-compacted and/or contaminated soil shall be loosened or replaced at no expense to the Owner.
2. Where modified existing soil has become compacted or contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.5 - Measurement

All acceptable surface and subsurface decompaction will be measured by the square yard.

Existing soil that is modified by tilling, or ripping shall have a density to the depth of the modification, after completion of the loosening, such that the compaction readings at each tested location are in the Excellent to Fair ranges as defined above, at soil moisture approximately the mid-point between wilting point and field capacity. Soil that is modified by subsoiling shall have trenches of uniform depth and spacing throughout the subsoiled area.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.6 - Payment

Payment for Soil Decompaction shall be made according to the unit price for completion of all components necessary to decompact work areas, and shall include all labor, tools, equipment, water, measuring devices, testing, materials, supplies, and incidentals to complete the work:

Item No. 661S-A	Compacted Surface Soil: Tilling	Per Square Yard
Item No. 661S-B	Compacted Subsoil: Ripping to a depth of (x) inches	Per Square Yard
Item No. 661S-C	Compacted Subsoil: Subsoiling to a depth of (x) inches	Per Square Yard
Item No. 661S-D	Compacted Surface Soil: Root Zone - AFM	Per Square Yard
Item No. 661S-E	Compacted Surface Soil: Root Zone - Vertical Mulching	Per Square Yard
Item No. 661S-F	Aluminum post and chain barriers for trees	Per Linear Foot

Source: [Rule No. R161-16.21, 11-14-16](#).

End

ITEM NO. 700S - MOBILIZATION 9-26-12**700S.1 - Description**

This item shall govern the mobilization of personnel, equipment and materials at the work site for other contract items that will be performed by the Contractor. Mobilization shall include, but not be limited to the movement of equipment, personnel, material, supplies, etc. to the Work site; the installation of temporary facilities (when not paid for separately) and the establishment of office and other necessary facilities prior to the initiation of the Work. The cost of the Payment Bond and Performance Bond on the Work that is delayed due to circumstances beyond Contractor's control, a closed construction season or for the convenience of the City of Austin will be considered part of the mobilization item under this Contract.

700S.2 - Measurement.

Measurement of the Specification Item, "Mobilization", as specified herein as "Total Mobilization Payment", will be by the "Lump Sum", as the Work progresses.

700S.3 - Payment.

The adjusted contract amount as used below is defined as the original contract amount less the lump sum bid for Mobilization and any payments for materials or equipment not yet incorporated in the Work. The Contractor shall submit a lump sum amount for Payment Item No. 700S-TM, "Total Mobilization Payment".

"Initial Mobilization Payout" as used below is defined as:

1. 8% of the original contract amount for projects with an original contract amount of \$ 0.5 million or less; or
2. 4% of the original contract amount for projects with an original contract amount greater than \$ 0.5 million.

In those instances where the "Initial Mobilization Payout", as defined above, exceeds the "Total Mobilization Payment" lump sum bid item (i.e. Payment Item No. 700S-TM), the "Total Mobilization Payment" shall be used as the "Initial Mobilization Payout". In no instance shall the "Initial Mobilization Payout" exceed the "Total Mobilization Payment" bid item.

Partial payments of the "Initial Mobilization Payout" shall be as follows:

- A. Upon presentation of a paid invoice for the Payment Bond, Performance Bond and/or required insurance, the Contractor will be paid that cost from the amount bid for "Total Mobilization Payment".
- B. The Mobilization of tunnel boring machines, batch plants or other similar facilities, along with supporting materials and equipment, to the work site or to the vicinity of the Work site will be considered as partial Mobilization under this contract. The Contractor shall provide a certified statement of the Contractor's expenditure for the Mobilization and setup of the facility and supporting equipment. Upon approval by the Engineer or designated representative, the certified expenditure will be paid from the amount bid for the Specification Item, "Total Mobilization Payment". In no case shall the combined amount for all of these facilities be more than 10 percent of the Mobilization "Total Mobilization Payment" lump sum bid or one (1) percent of the total contract amount, whichever is less.
- C. When one (1) percent of the adjusted contract amount is earned, 50 percent of the "Initial Mobilization Payout" will be paid. Previous payments under this item will be deducted from this amount.

- D. When five (5) percent of the adjusted contract amount is earned, seventy-five (75) of the "Initial Mobilization Payout will be paid. Previous payments under this item will be deducted from this amount.
- E. When ten (10) percent of the adjusted contract amount is earned, one hundred (100) percent of the "Initial Mobilization Payout will be paid. Previous payments under this item will be deducted from this amount.
- F. Payment for the remainder of Pay Item No. 700S-TM, "Total Mobilization Payment" will be made upon receipt of the final pay estimate.

Payment will be made under:

Pay Item No. 700S-TM:	"Total Mobilization Payment"	Lump Sum
------------------------------	-------------------------------------	-----------------

End

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 700S, "MOBILIZATION"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
00020	Invitation for Bids
00100	Instructions To Bidders
00300	Bid Form
00425	Insurance Cost Form
00500	Agreement
00610	Performance Bond
00620	Bid Bond
00650	Certificate of Insurance

00700	General Conditions
00810	Supplemental General Conditions
00820	Modifications to Bidding Requirements & Contract Forms
01010	Summary of Work
01300	Submittals
01500	Temporary Facilities
01550	Public Safety and Convenience
01700	Contract Closeout
01710	Final Cleaning

ITEM NO. 803S - BARRICADES, SIGNS AND TRAFFIC HANDLING 11-15-11**803S.1 - Description**

This item shall govern for providing, installing, moving, replacing, maintaining, cleaning and removing upon completion of the work, all temporary or permanent street closure barricades, signs, cones, lights or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform Traffic Control Devices for Street and Highways and as indicated on the Drawings or directed by the Engineer or designated representative.

Constructing a detour, if required, shall conform to Standard Specification Item No. 801S, "Constructing a Detour." Capital Improvement Project Signs shall conform to Standard Specification Item No. 802S, "Project Signs."

This item shall also include the installation of all required safety fencing as described in the latest adopted version of Standard Detail 804S-4.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

803S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type of Barricade and proposed materials and Construction of the barricade,
- B. Test results for Retro-Reflective sheeting.

803S.3 - Materials

All barricades, signs, cones, lights and other types of devices to handle traffic, as indicated on the Drawings or directed by the Engineer or designated representative, shall conform to details shown on the Drawings or those indicated in the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

803S.4 - Construction Methods

Prior to commencement of construction, suitable "Barricades, Signs and Traffic Handling" devices shall be installed to protect the workers and the public.

The Contractor shall be responsible for the installation of all markers, signs and barricades in accordance with the Drawings and in conformance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and/or as indicated on the Drawings or directed by the Engineer or designated representative. If, in the opinion of the Engineer or designated representative, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer or designated representative. All changes and/or revisions to the detour/traffic control plan shall be approved by the Engineer or designated representative.

Lumber shall be painted with two coats of paint as indicated on the Drawings.

803S.5 - Maintenance

It shall be the Contractor's responsibility to maintain, clean, move and replace if necessary, barricades, signs and traffic handling devices during the time required for construction of the project. Permanent barricades shall be constructed as required after the completion of the street by drilling holes to place the posts and concrete foundations. Foundation concrete shall be cured before the rails are attached. When

no longer needed, all temporary Barricades, Signs and Traffic Handling Devices shall be removed and the area restored to its original condition or as directed by the Engineer or designated representative.

803S.6 - Measurement

The work performed and material furnished as prescribed by this item, City of Austin Standard Details, details included on the Drawings or indicated in the TMUTCD shall be measured as follows:

A. Pavement Markings.

All pavement marking required for proper installation of the designated Traffic Control Plans and Details, as well as required removal of existing pavement marking, shall be measured and paid for under Standard Specification Item No. 870S, "Work Zone Pavement Markings" and Standard Specification Item No. 874S, "Eliminating Existing Pavement Markings".

B. Barricades, Signs and Traffic Handling.

All work performed and material furnished as prescribed by this item, City of Austin Standard Details, details shown on the Drawings or indicated in the TMUTCD, that are not included in the above paragraph, shall be measured by the number of calendar days, working days or months of actual service.

Traffic control for the project will be measured and paid for once per contract defined time period, i.e. either per Calendar Day, Working day or Month at the contract rate, regardless of the number of set-ups, locations or streets under construction.

C. Safety Fencing

Safety fencing will be measured by the lineal foot.

803S.7 - Payment

The work performed and materials furnished as prescribed by this item, measured as provided under section "803S.6 Measurement" shall be paid for at the contract unit price for barricades, signs and traffic handling. This unit price shall include full compensation for furnishing, placement and removal of all materials and for all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 803S-CD:	Barricades, Signs, and Traffic Handling	Per Calendar Day.
Pay Item No. 803S-WD:	Barricades, Signs, and Traffic Handling	Per Working Day.
Pay Item No. 803S-MO:	Barricades, Signs, and Traffic Handling	Per Month.
Pay Item No. 803S-SF:	Safety Fence	Per Lineal Foot.

End

SPECIFIC CROSS REFERENCE MATERIALSSpecification Item No. 803S, "Barricades, Signs and Traffic Handling"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 801S	Constructing a Detour
Item No. 802S	Project Signs
Item No. 870S	Work Zone Pavement Markings
Item No. 874S	Eliminating Existing Pavement Markings and Markers

Texas Technical Documents:

<u>Designation</u>	<u>Description</u>
(TMUTCD)	Texas Manual on Uniform Traffic Control Devices

RELATED CROSS REFERENCE MATERIALSSpecification Item No. 803S, "Barricades, Signs and Traffic Handling"

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures

Item No. 860S	Pavement Marking Paint (Reflectorized)
Item No. 863S	Reflectorized Pavement Markers
Item No. 864S	Abbreviated Pavement Markings
Item No. 867S	Epoxy Adhesive
Item No. 871S	Reflectorized Pavement Markings
Item No. 875S	Pavement Surface Preparation For Markings

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
803S-1	Street-End Barricades

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item No. 502	Barricades, Signs and Traffic Handling
Item No. 508	Constructing Detours
Item No. 510	One-Way Traffic Control

Item No. 512	Portable Concrete Traffic Barrier
Item No. 514	Permanent Concrete Traffic Barrier
Item No. 662	Work Zone Pavement Markings
Item No. 666	Reflectorized Pavement Markings
Item No. 667	Prefabricated Pavement Markings
Item No. 672	Raised Pavement Markers
Item No. 677	Eliminating Existing Pavement Markings and Markers
Item No. 678	Pavement Surface Preparation For Markings
<u>Texas Department of Transportation: Departmental Materials Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS 7110	Aluminum Sign Blanks
DMS 8310	Flexible Roll-up Reflective Signs
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-839-B	Determining Color in Reflective Materials
Tex-842-B	Method for Measuring Retroreflectivity
<u>American Society for Testing and Materials (ASTM)</u>	

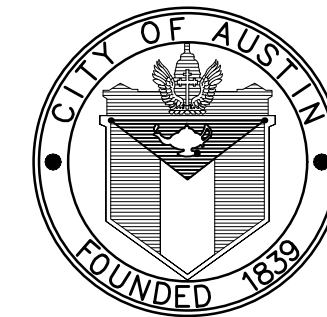
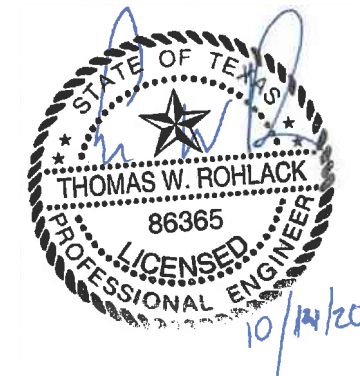
<u>Designation</u>	<u>Description</u>
A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners
A-320	Specification for Alloys-Steel Bolting Materials for Low-Temperature Service
A-513	Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
B-108/B108M	Specification for Aluminum-Alloy Permanent Mold Castings
B-183	Practice for Preparation of Low-Carbon Steel for Electroplating
B-221/B-221M	Specification for Aluminum-Alloy Extended Bars, Rods, Wire, Shapes, and Tubes
D-523	Test Method for Specular Gloss
D-822	Recommended Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products
D-828	Test Method for Tensile Breaking Strength of Paper and Paperboard
G-23	Recommended Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials

CADD FILE: \\CAS-DATASERVER\WATER\ACTIVE PROJECTS\COA W & NW LARGE & SMALL SCALE FACILITIES\HULLRICH LSPS SWITCHGEAR PROJECT\3.0 WORK PRODUCTS\HULLRICH LSPS SWITCHGEAR PROJECT\10/14/2020 4:55:18 PM BY: JANE FU CTB FILE: HULLRICH LSPS SWITCHGEAR PROJECT\10/14/2020 4:55:18 PM BY: JANE FU CTB FILE:



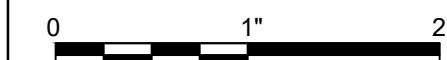
C	10/14/2020	ADDENDUM 4
B	10/09/2020	ADDENDUM 3
A	07/13/2020	ISSUED FOR BIDS
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	TR
DRAWN BY	JC
CHECKED BY	TR
DATE	
PROJECT NUMBER	1126



ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL

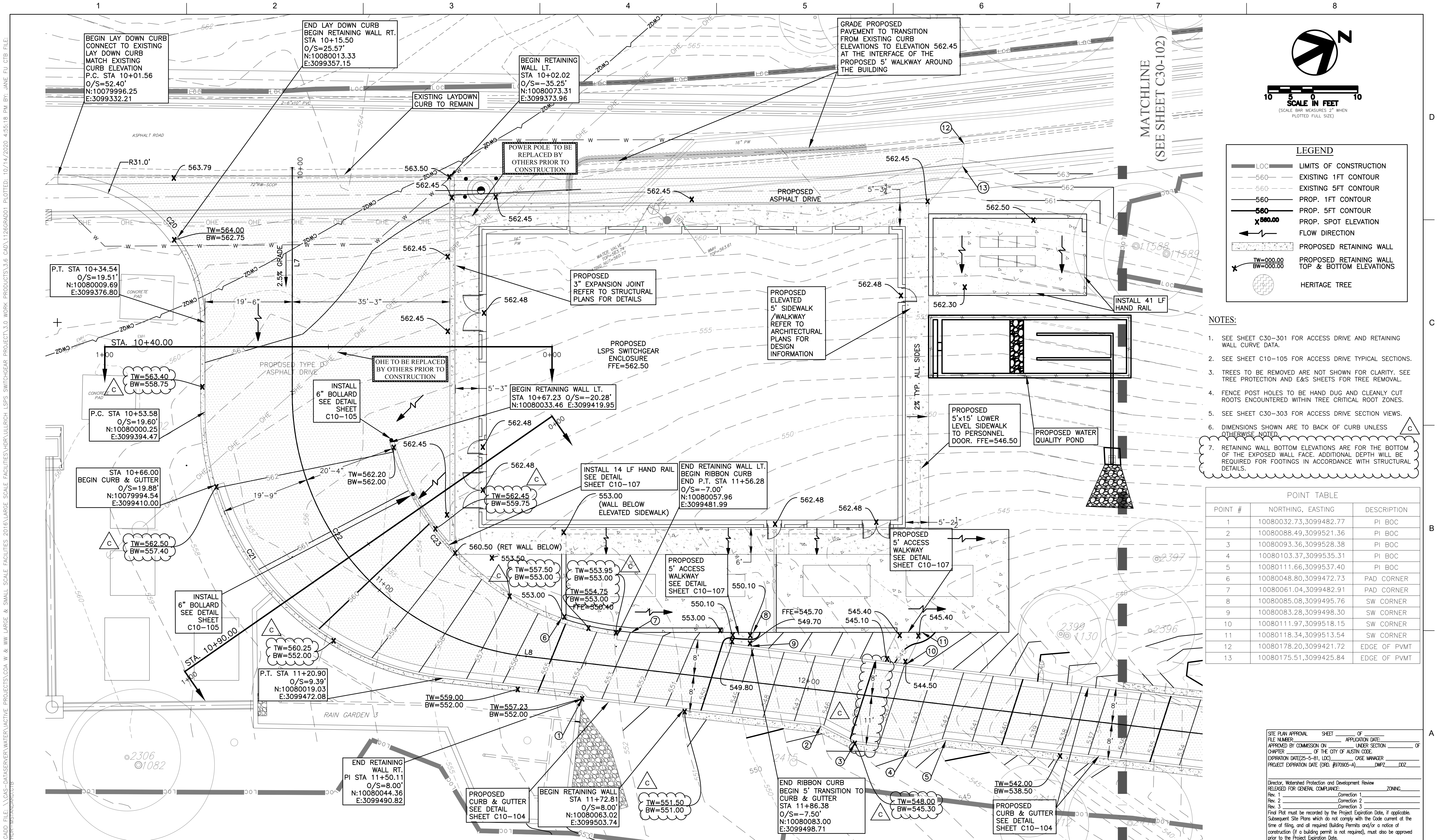
LSPS SWITCHGEAR ENCLOSURE
AND ACCESS DRIVE
GRADING PLAN (1 OF 4)



FILENAME 1126GRAD01.dwg
SCALE 1" = 10'

SHEET
C30-101

SPC-03-005C (R2)



LEGEND

- LOC LIMITS OF CONSTRUCTION
- 560- EXISTING 1FT CONTOUR
- 560- EXISTING 5FT CONTOUR
- 560- PROP. 1FT CONTOUR
- 560- PROP. 5FT CONTOUR
- X 560.00 PROP. SPOT ELEVATION
- Flow arrow FLOW DIRECTION
- Proposed retaining wall symbol PROPOSED RETAINING WALL
- TW=000.00 BW=000.00 PROPOSED RETAINING WALL TOP & BOTTOM ELEVATIONS
- Heritage tree symbol HERITAGE TREE

- NOTES:**
- SEE SHEET C30-301 FOR ACCESS DRIVE AND RETAINING WALL CURVE DATA.
 - SEE SHEET C10-105 FOR ACCESS DRIVE TYPICAL SECTIONS.
 - TREES TO BE REMOVED ARE NOT SHOWN FOR CLARITY. SEE TREE PROTECTION AND E&S SHEETS FOR TREE REMOVAL.
 - FENCE POST HOLES TO BE HAND DUG AND CLEANLY CUT. ROOTS ENCOUNTERED WITHIN TREE CRITICAL ROOT ZONES.
 - SEE SHEET C30-303 FOR ACCESS DRIVE SECTION VIEWS.
 - DIMENSIONS SHOWN ARE TO BACK OF CURB UNLESS OTHERWISE NOTED.
 - RETAINING WALL BOTTOM ELEVATIONS ARE FOR THE BOTTOM OF THE EXPOSED WALL FACE. ADDITIONAL DEPTH WILL BE REQUIRED FOR FOOTINGS IN ACCORDANCE WITH STRUCTURAL DETAILS.

POINT TABLE		
POINT #	NORTHING, EASTING	DESCRIPTION
1	10080032.73, 3099482.77	PI BOC
2	10080088.49, 3099521.36	PI BOC
3	10080093.36, 3099528.38	PI BOC
4	10080103.37, 3099535.31	PI BOC
5	10080111.66, 3099537.40	PI BOC
6	10080048.80, 3099472.73	PAD CORNER
7	10080061.04, 3099482.91	PAD CORNER
8	10080085.08, 3099495.76	SW CORNER
9	10080083.28, 3099498.30	SW CORNER
10	10080111.97, 3099518.15	SW CORNER
11	10080118.34, 3099513.54	SW CORNER
12	10080178.20, 3099421.72	EDGE OF PVMT
13	10080175.51, 3099425.84	EDGE OF PVMT

SITE PLAN APPROVAL SHEET OF
FILE NUMBER _____ APPLICATION DATE: _____
APPROVED BY COMMISSION ON _____ UNDER SECTION _____ OF
CHAPTER _____ OF THE CITY OF AUSTIN CODE
EXPIRATION DATE(25-5-81, LDC) _____ CASE NUMBER _____
PROJECT EXPIRATION DATE (ORD. #97095-A) _____ DWPZ DOZ _____

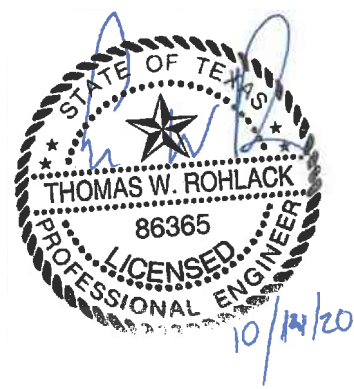
Director, Watershed Protection and Development Review
RELEASED FOR GENERAL COMPLIANCE: _____ ZONING _____
Rev. 1 _____ Correction 1 _____
Rev. 2 _____ Correction 2 _____
Rev. 3 _____ Correction 3 _____
Find Plat must be recorded by the Project Expiration Date, if applicable.
Subsequent Site Plans which do not comply with the Code current at the
time of filing, and all required Building Permits and/or a notice of
construction (if a building permit is not required), must also be approved
prior to the Project Expiration Date.

CADD FILE: \\CAS-DATASERVER\WATER\ACTIVE PROJECTS\COA W & NW LARGE & SMALL SCALE FACILITIES\HRR\ULLRICH LSPS SWITCHGEAR PROJECT\3.6 CAD\126GRAD02 PLOTTED- 10/14/2020 11:02:32 AM BY: JANE FU CTB FILE: HRR-MSTANDARD.CTB



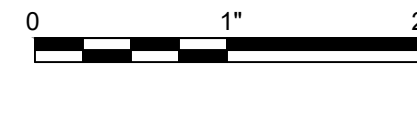
C	10/14/2020	ADDENDUM 4
B	10/09/2020	ADDENDUM 3
A	07/13/2020	ISSUED FOR BIDS
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	MCM
DRAWN BY	DCH
CHECKED BY	MCM
DATE	
PROJECT NUMBER	1126



ULLRICH WTP LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

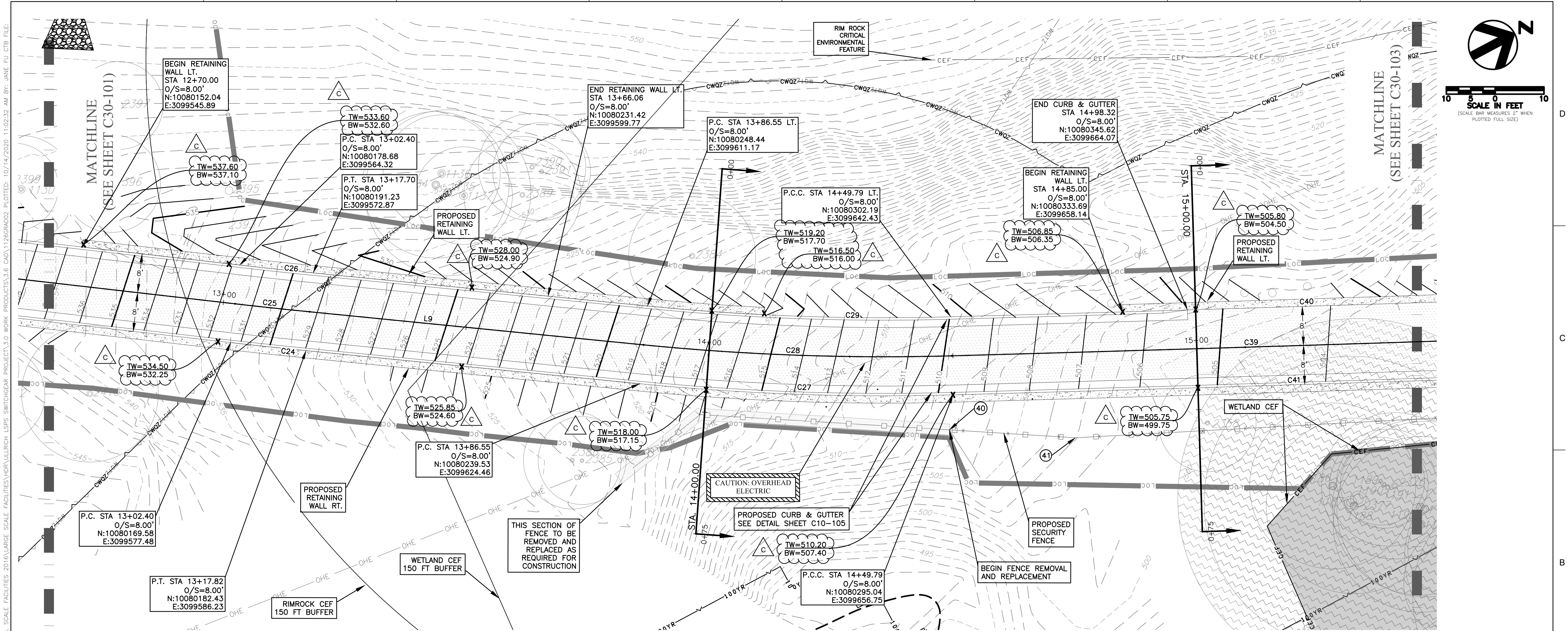
LSPS SWITCHGEAR ENCLOSURE AND ACCESS DRIVE GRADING PLAN (2 OF 4)



FILENAME 1126GRAD02.dwg
SCALE 1" = 10'

SHEET
C30-102

SPC-03-005C (R2)



POINT TABLE		
POINT #	NORTHING, EASTING	DESCRIPTION
40	10080291.00, 3099692.72	PI FENCE
41	10080313.02, 3099676.34	PI FENCE

NOTES:

- SEE SHEET C30-301 FOR ACCESS DRIVE AND RETAINING WALL CURVE DATA.
- SEE SHEET C10-105 FOR ACCESS DRIVE TYPICAL SECTIONS.
- TREES TO BE REMOVED ARE NOT SHOWN FOR CLARITY. SEE TREE PROTECTION AND E&S SHEETS FOR TREE REMOVAL.
- FENCE POST HOLES TO BE HAND DUG AND CLEANLY CUT ROOTS ENCOUNTERED WITHIN TREE CRITICAL ROOT ZONES.
- SEE SHEET C30-303 FOR ACCESS DRIVE SECTION VIEWS.
- DIMENSIONS SHOWN ARE TO BACK OF CURB UNLESS OTHERWISE NOTED.
- RETAINING WALL BOTTOM ELEVATIONS ARE FOR THE BOTTOM OF THE EXPOSED WALL FACE. ADDITIONAL DEPTH WILL BE REQUIRED FOR FOOTINGS IN ACCORDANCE WITH STRUCTURAL DETAILS.

LEGEND

LOC	LIMITS OF CONSTRUCTION
-560-	EXISTING 1FT CONTOUR
-560-	EXISTING 5FT CONTOUR
-560-	PROP. 1FT CONTOUR
-560-	PROP. 5FT CONTOUR
X 500.00	PROP. SPOT ELEVATION
←	FLOW DIRECTION
RETAINING WALL	PROPOSED RETAINING WALL
TW=000.00 BW=000.00	PROPOSED RETAINING WALL TOP & BOTTOM ELEVATIONS
HERITAGE TREE	HERITAGE TREE

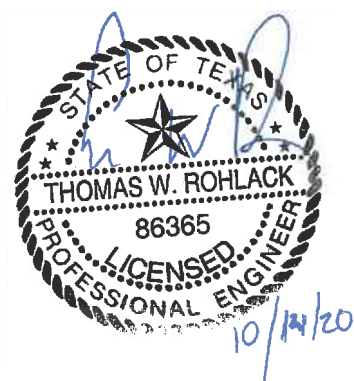
SITE PLAN APPROVAL	SHEET	OF
FILE NUMBER	APPLICATION DATE	
APPROVED BY COMMISSION ON	UNDER SECTION	OF
CHAPTER	OF THE CITY OF AUSTIN CODE	
EXPIRATION DATE(25-5-81, LDC)	CASE MANAGER	
PROJECT EXPIRATION DATE (ORD. #970905-A)	DWPZ	D02
Director, Watershed Protection and Development Review		
RELEASED FOR GENERAL COMPLIANCE: ZONING		
Rev. 1	Correction 1	
Rev. 2	Correction 2	
Rev. 3	Correction 3	
Find Plot must be recorded by the Project Expiration Date, if applicable. Subsequent Site Plans which do not comply with the Code current at the time of filing, and all required Building Permits and/or a notice of construction (if a building permit is not required), must also be approved prior to the Project Expiration Date.		

CADD FILE: \\CAS-DATASERVER\WATER\ACTIVE PROJECTS\COA W & NW LARGE & SMALL SCALE FACILITIES\HULLRICH LSPS SWITCHGEAR PROJECT\3.0 WORK PRODUCTS\1126GRAD03 PLOTTED: 10/14/2020 11:35:00 PM BY: JANE FU CTB FILE: \\HULLRICH\PROJECTS\COA W & NW LARGE & SMALL SCALE FACILITIES\HULLRICH LSPS SWITCHGEAR PROJECT\3.0 WORK PRODUCTS\1126GRAD03 PLOTTED: 10/14/2020 11:35:00 PM BY: JANE FU CTB FILE:



C	10/14/2020	ADDENDUM 4
B	10/09/2020	ADDENDUM 3
A	07/13/2020	ISSUED FOR BIDS
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	MCM
DRAWN BY	DCH
CHECKED BY	MCM
DATE	
PROJECT NUMBER	1126

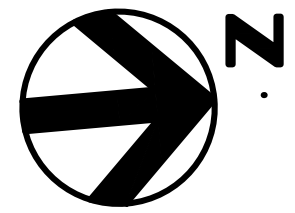
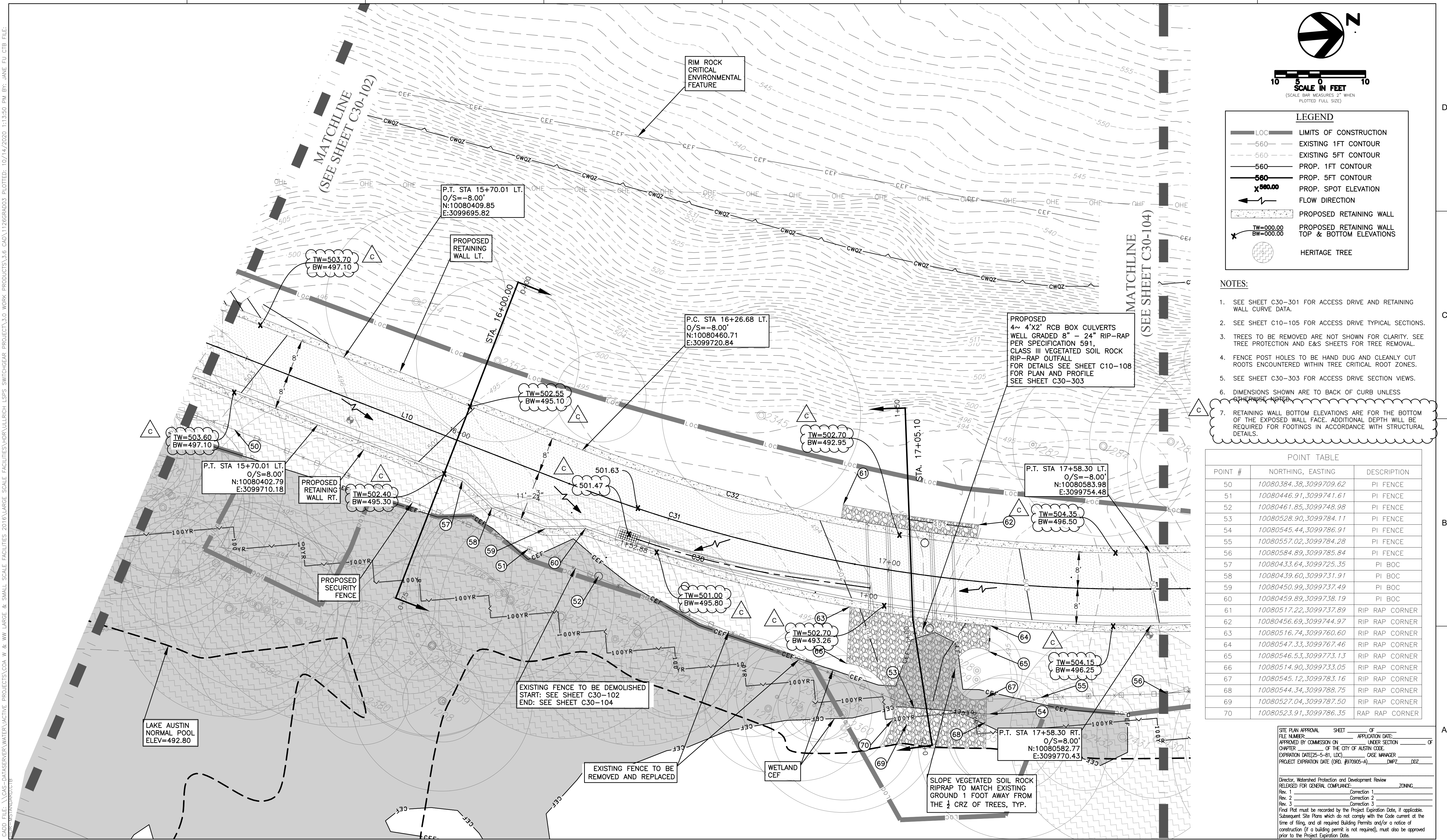


ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL

LSPS SWITCHGEAR ENCLOSURE
AND ACCESS DRIVE
GRADING PLAN (3 OF 4)

FILENAME	1126GRAD03.dwg
SCALE	1" = 10'

SHEET
C30-103



SCALE IN FEET
10 5 0 5 10
(SCALE BAR MEASURES 2" WHEN PLOTTED FULL SIZE)

LEGEND

- LOC LIMITS OF CONSTRUCTION
- 560 EXISTING 1FT CONTOUR
- 560 EXISTING 5FT CONTOUR
- 560 PROP. 1FT CONTOUR
- 560 PROP. 5FT CONTOUR
- 560.00 PROP. SPOT ELEVATION
- Flow Direction
- PROPOSED RETAINING WALL
- PROPOSED RETAINING WALL TOP & BOTTOM ELEVATIONS
- HERITAGE TREE

NOTES:

- SEE SHEET C30-301 FOR ACCESS DRIVE AND RETAINING WALL CURVE DATA.
- SEE SHEET C10-105 FOR ACCESS DRIVE TYPICAL SECTIONS.
- TREES TO BE REMOVED ARE NOT SHOWN FOR CLARITY. SEE TREE PROTECTION AND E&S SHEETS FOR TREE REMOVAL.
- FENCE POST HOLES TO BE HAND DUG AND CLEANLY CUT ROOTS ENCOUNTERED WITHIN TREE CRITICAL ROOT ZONES.
- SEE SHEET C30-303 FOR ACCESS DRIVE SECTION VIEWS.
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- RETAINING WALL BOTTOM ELEVATIONS ARE FOR THE BOTTOM OF THE EXPOSED WALL FACE. ADDITIONAL DEPTH WILL BE REQUIRED FOR FOOTINGS IN ACCORDANCE WITH STRUCTURAL DETAILS.

POINT TABLE

POINT #	NORTHING, EASTING	DESCRIPTION
50	10080384.38, 3099709.62	PI FENCE
51	10080446.91, 3099741.61	PI FENCE
52	10080461.85, 3099748.98	PI FENCE
53	10080528.90, 3099784.11	PI FENCE
54	10080545.44, 3099786.91	PI FENCE
55	10080557.02, 3099784.28	PI FENCE
56	10080584.89, 3099785.84	PI FENCE
57	10080433.64, 3099725.35	PI BOC
58	10080439.60, 3099731.91	PI BOC
59	10080450.99, 3099737.49	PI BOC
60	10080459.89, 3099738.19	PI BOC
61	10080517.22, 3099737.89	RIP RAP CORNER
62	10080456.69, 3099744.97	RIP RAP CORNER
63	10080516.74, 3099760.60	RIP RAP CORNER
64	10080547.33, 3099767.46	RIP RAP CORNER
65	10080546.53, 3099773.13	RIP RAP CORNER
66	10080514.90, 3099733.05	RIP RAP CORNER
67	10080545.12, 3099783.16	RIP RAP CORNER
68	10080544.34, 3099788.75	RIP RAP CORNER
69	10080527.04, 3099787.50	RIP RAP CORNER
70	10080523.91, 3099786.35	RAP RAP CORNER

SITE PLAN APPROVAL SHEET OF
FILE NUMBER: _____ APPLICATION DATE: _____
APPROVED BY COMMISSION ON _____ UNDER SECTION _____ OF
OF THE CITY OF AUSTIN CODE
CHAPTER _____ OF THE CITY OF AUSTIN CODE
EXPIRATION DATE(25-5-81, LDC) _____ CASE MANAGER _____
PROJECT EXPIRATION DATE (ORD. #970905-A) _____ DWPZ DOZ _____

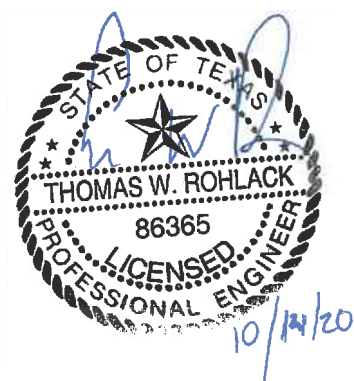
Director, Watershed Protection and Development Review
RELEASED FOR GENERAL COMPLIANCE: _____ ZONING _____
Rev. 1 _____ Correction 1 _____
Rev. 2 _____ Correction 2 _____
Rev. 3 _____ Correction 3 _____
Find Plot must be recorded by the Project Expiration Date, if applicable.
Subsequent Site Plans which do not comply with the Code current at the
time of filing, and all required Building Permits and/or a notice of
construction (if a building permit is not required), must also be approved
prior to the Project Expiration Date.

CADD FILE: \\CAS-DATASERVER\WATER\ACTIVE PROJECTS\COA W & NW LARGE & SMALL SCALE FACILITIES\HORYULLRICH LSPS SWITCHGEAR PROJECT\3.0 WORK PRODUCTS\3.6 CAD\1126GRAD04.PLOTTED: 10/14/2020 4:54:31 PM BY: JANE FU CTB FILE: HR-MSTANDARD.CTB



ISSUE	DATE	DESCRIPTION
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B	10/09/2020	ADDENDUM 3
A	07/13/2020	ISSUED FOR BIDS

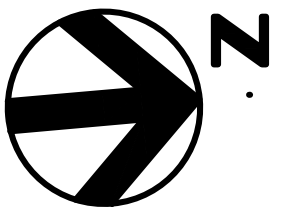
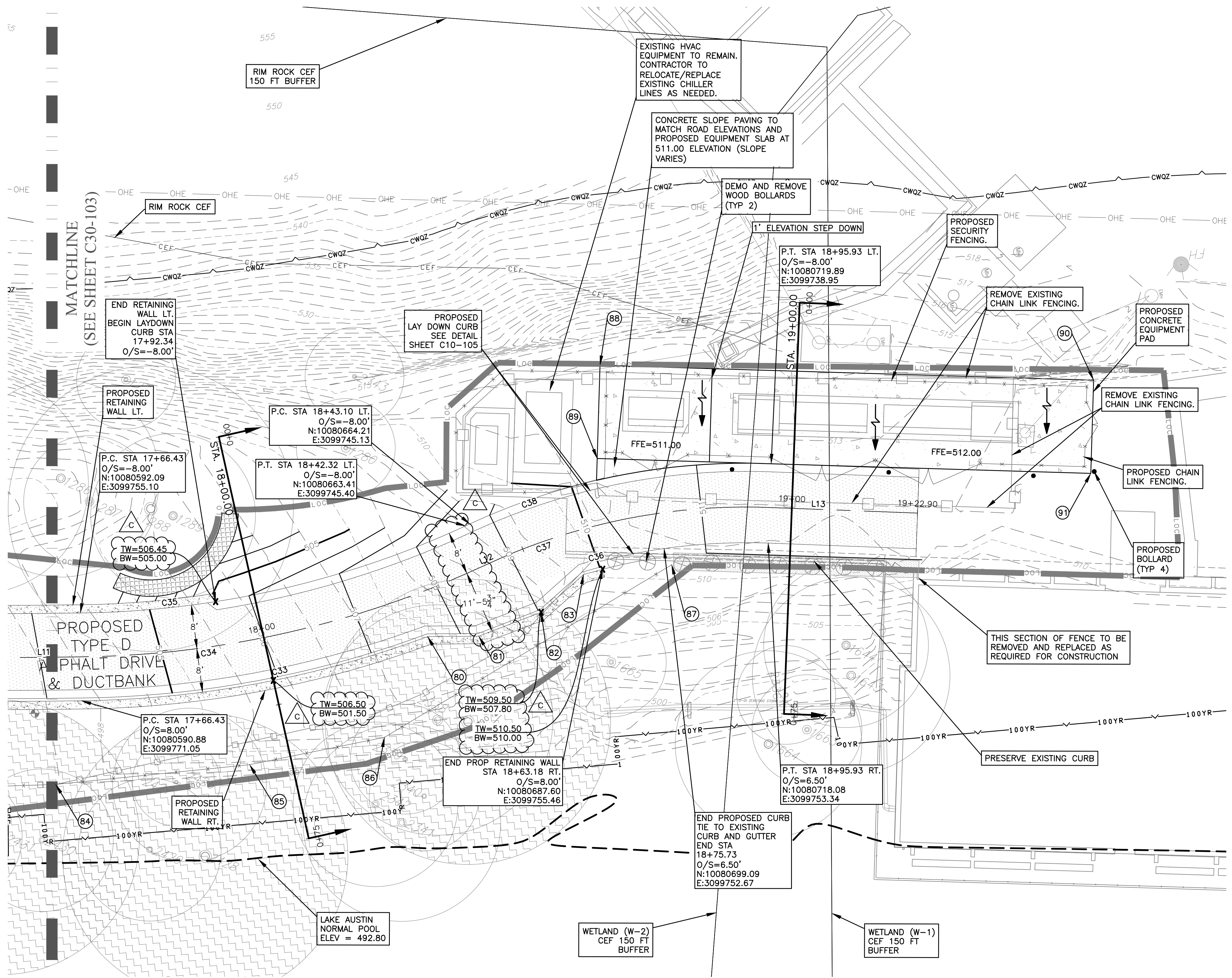
PROJECT MANAGER	
DESIGNED BY	TR
DRAWN BY	JC
CHECKED BY	TR
DATE	
PROJECT NUMBER	1126



ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL

FILENAME	1126GRAD04.dwg
SCALE	1" = 10'

SHEET
C30-104



LEGEND

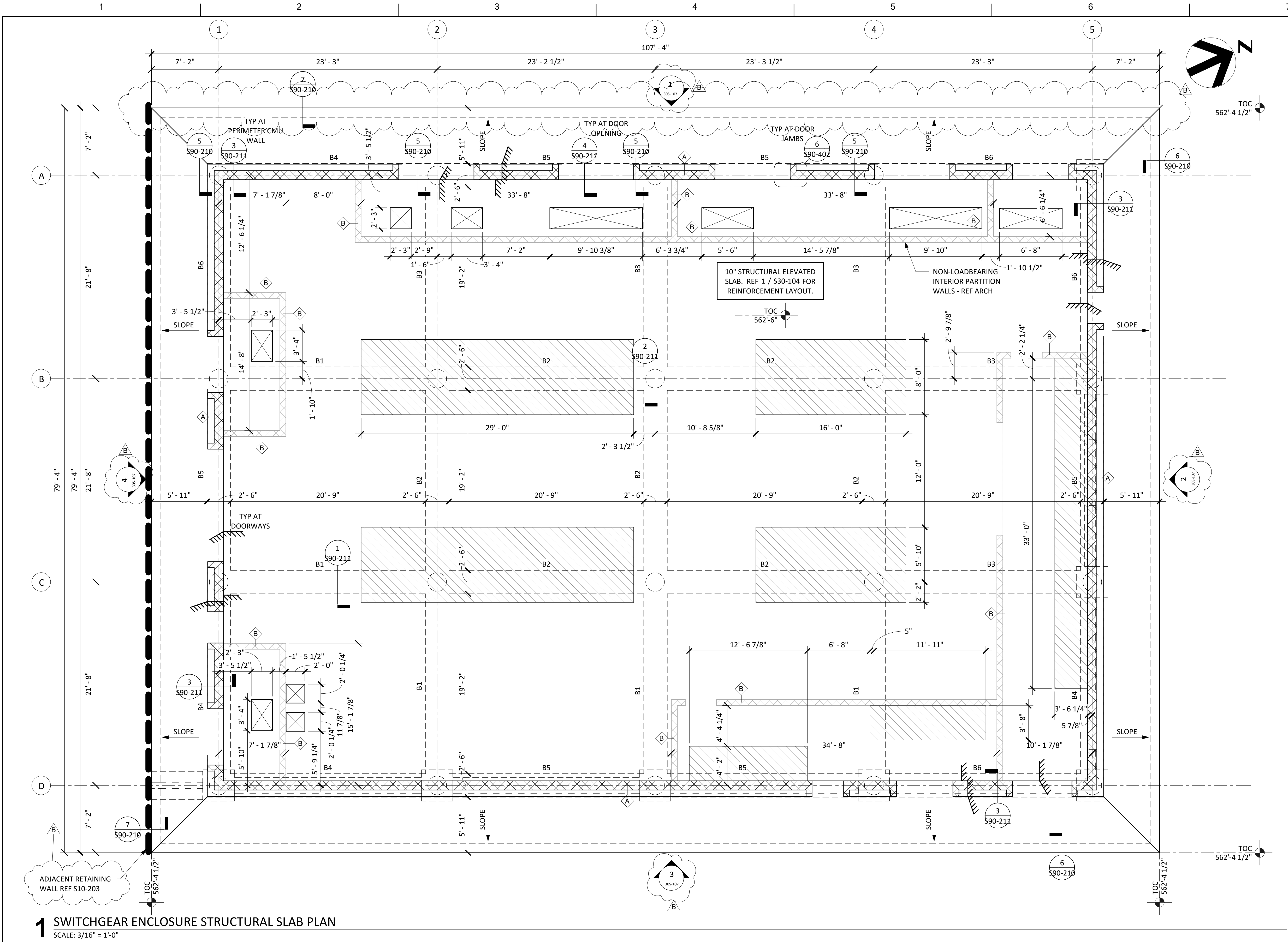
- LOC LIMITS OF CONSTRUCTION
- 560- EXISTING 1FT CONTOUR
- 560- EXISTING 5FT CONTOUR
- 560- PROP. 1FT CONTOUR
- 560- PROP. 5FT CONTOUR
- x560.00 PROP. SPOT ELEVATION
- Flow arrow FLOW DIRECTION
- Proposed retaining wall symbol PROPOSED RETAINING WALL
- TW=000.00 BW=600.00 PROPOSED RETAINING WALL TOP & BOTTOM ELEVATIONS
- Heritage tree symbol HERITAGE TREE

- NOTES:**
- SEE SHEET C30-301 FOR ACCESS DRIVE AND RETAINING WALL CURVE DATA.
 - SEE SHEET C10-105 FOR ACCESS DRIVE TYPICAL SECTIONS.
 - TREES TO BE REMOVED ARE NOT SHOWN FOR CLARITY. SEE TREE PROTECTION AND E&S SHEETS FOR TREE REMOVAL.
 - FENCE POST HOLES TO BE HAND DUG AND CLEANLY CUT ROOTS ENCOUNTERED WITHIN TREE CRITICAL ROOT ZONES.
 - SEE SHEET C30-303 FOR ACCESS DRIVE SECTION VIEWS.
 - DIMENSIONS SHOWN ARE TO BACK OF CURB UNLESS OTHERWISE NOTED.
 - RETAINING WALL BOTTOM ELEVATIONS ARE FOR THE BOTTOM OF THE EXPOSED WALL FACE. ADDITIONAL DEPTH WILL BE REQUIRED FOR FOOTINGS IN ACCORDANCE WITH STRUCTURAL DETAILS.

POINT TABLE		
POINT #	NORTHING, EASTING	DESCRIPTION
80	10080654.76, 3099764.91	PI BOC
81	10080664.05, 3099765.64	PI BOC
82	10080675.75, 3099762.28	PI BOC
83	10080684.05, 3099756.12	PI BOC
84	10080584.89, 3099785.84	PI FENCE
85	10080620.40, 3099785.33	PI FENCE
86	10080645.31, 3099782.50	PI FENCE
87	10080700.21, 3099755.73	PI FENCE
88	10080690.37, 3099718.38	PAD CORNER
89	10080688.37, 3099735.26	PAD CORNER
90	10080779.74, 3099728.93	PAD CORNER
91	10080777.75, 3099745.81	PAD CORNER

SITE PLAN APPROVAL SHEET OF
FILE NUMBER _____ APPLICATION DATE: _____
APPROVED BY COMMISSION ON _____ UNDER SECTION _____ OF
CHAPTER _____ OF THE CITY OF AUSTIN CODE
EXPIRATION DATE(25-5-81, LDC) _____ CASE MANAGER _____
PROJECT EXPIRATION DATE (ORD. #970905-A) DWP2 DOZ _____

Director, Watershed Protection and Development Review
RELEASED FOR GENERAL COMPLIANCE: _____ ZONING _____
Rev. 1 _____ Correction 1 _____
Rev. 2 _____ Correction 2 _____
Rev. 3 _____ Correction 3 _____
Final Plot must be recorded by the Project Expiration Date, if applicable.
Subsequent Site Plans which do not comply with the Code current at the
time of filing, and all required Building Permits and/or a notice of
construction (if a building permit is not required), must also be approved
prior to the Project Expiration Date.



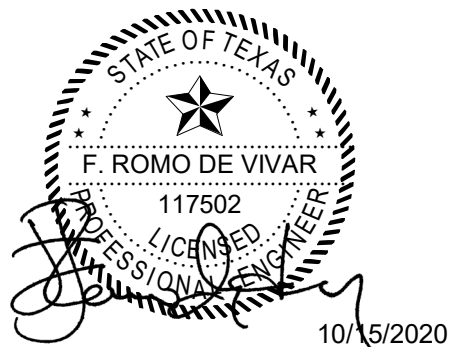
- STRUCTURAL SLAB PLAN NOTES**
- Top of structural concrete is denoted as follows:
 - CMU walls are denoted as follows:
 - 6" Housekeeping pads for equipment are denoted as follows:
 - These structural drawings do not address water issues as it relates to but not limited to site drainage, roof runoff, or water introduced by adjacent properties. Adequate drainage shall be provided to limit the effects of erosion and to maintain the integrity of the structural system described. Water issues and/or waterproofing are the responsibility of the Architect and Contractor and are beyond the scope of these documents.
 - Verify all dimensions, elevations, finish surfaces, slopes, drains, depressions, curbs etc. with architectural, mechanical, electrical, and plumbing drawings prior to start of construction.
 - Refer to architectural drawings for all opening dimensions and locations.
 - All steel permanently exposed to the elements shall be galvanized.
 - Refer to 00S-000 series for Structural Notes.
 - Refer to 90S-200 series for Typical Concrete Details.
 - Refer to 90S-400 series for Typical CMU Details.

CMU WALL SCHEDULE				
MARK	NOMINAL WALL THICKNESS	REINFORCEMENT	MAX HEIGHT	LOAD BEARING?
A	12"	(2) #5 @ 24" OC	28'-6"	YES
B	8"	#5 @ 24" OC	10'-0"	NO

1 SWITCHGEAR ENCLOSURE STRUCTURAL SLAB PLAN
SCALE: 3/16" = 1'-0"

ISSUE	DATE	DESCRIPTION
B	10/15/2020	REISSUED PER ADDENDUM NO. 4
A	08/21/2020	ISSUE FOR BID

PROJECT MANAGER	W.D. WEHNER
DESIGNED BY	AR / FRV
DRAWN BY	AR
CHECKED BY	FRV
DATE	OCTOBER 2020
PROJECT NUMBER	10123906



1	2	3	4	5	6	7	8
PROPOSED CONDUIT/WIRE SCHEDULE			C	PROPOSED CONDUIT/WIRE SCHEDULE			
CONDUIT TAG	SIZE	CABLE/WIRE DESCRIPTION		CONDUIT TAG	SIZE	CABLE/WIRE DESCRIPTION	
PAC-MCC7-F1	4"	3 350 kCMIL (P), 1 #2/0 (G)		SUB4-ATS1-C1	3/4"	4 #12 (C), 2 #12 (SP), 1 #12 (G)	
PAC-MCC7-F2	4"	3 350 kCMIL (P), 1 #2/0 (G)		SUB4-ATS1-C2	1-1/4"	12 #12 (C), 6 #12 (SP), 3 #12 (G)	
PAC-MCC7-F3	4"	EMPTY		SUB4-ATS1-EF1	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-102-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-ATS1-EF2	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-102-F1	5"	3 #2 15kV RATED SHIELDED CABLE (P), 1 #6 (G)		SUB4-ATS1-NF1	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-102-F2	5"	EMPTY		SUB4-ATS1-NF2	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-104-C	1-1/4"	19 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-BKRATS1-C	1"	8 #12 (C), 4 #12 (SP), 2 #12 (G)	
SUB4-105-C	1-1/2"	22 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-BKRATS1E-C	3/4"	4 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-106-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-BKRATS1E-F1	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-106-F1	5"	3 500 kCMIL 15kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		SUB4-BKRATS1E-F2	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-106-F2	5"	3 500 kCMIL 15kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		SUB4-BKRATS1E-F3	4"	EMPTY	
SUB4-106-F3	5"	EMPTY		SUB4-BKRATS1E-F4	4"	EMPTY	
SUB4-106-F4	5"	EMPTY		SUB4-BKRATS1N-C	3/4"	4 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-107-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-BKRATS1N-F1	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-107-F1	5"	3 #2 15kV RATED SHIELDED CABLE (P), 1 #6 (G)		SUB4-BKRATS1N-F2	4"	3 500 kCMIL (P), 1 250 kCMIL (G)	
SUB4-107-F2	5"	EMPTY		SUB4-BKRATS1N-F3	4"	EMPTY	
SUB4-108-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-BKRATS1N-F4	4"	EMPTY	
SUB4-108-F1	5"	3 #2 15kV RATED SHIELDED CABLE (P), 1 #6 (G)		SUB4-CC-G	1-1/4"	1 250 kCMIL (G)	
SUB4-108-F2	5"	EMPTY		SUB4-COM-A	3"	1 TYPE I FIBER OPTIC CABLE(S) (COM)	
SUB4-202-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-COM-B	3"	1 TYPE I FIBER OPTIC CABLE(S) (COM)	
SUB4-202-F1	5"	3 #2 15kV RATED SHIELDED CABLE (P), 1 #6 (G)		SUB4-EC3-G	1-1/4"	1 250 kCMIL (G)	
SUB4-202-F2	5"	EMPTY		SUB4-EC4-G	1-1/4"	1 250 kCMIL (G)	
SUB4-204-C	1-1/4"	19 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-FACP-C	3/4"	6 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-205-C	1-1/4"	13 #12 (C), 4 #12 (C), 1 #12 (G)		SUB4-HVAC1A-P	3/4"	3 #8 (P), 1 #8 (G)	
SUB4-206-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-HVAC1B-P	3/4"	3 #8 (P), 1 #8 (G)	
SUB4-206-F1	5"	3 500 kCMIL 15kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		SUB4-HVAC1-COM	1"	1 VENDOR CABLE	
SUB4-206-F2	5"	3 500 kCMIL 15kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		SUB4-HVAC1C-P	3/4"	3 #8 (P), 1 #8 (G)	
SUB4-206-F3	5"	EMPTY		SUB4-HVAC2A-P	3/4"	3 #8 (P), 1 #8 (G)	
SUB4-206-F4	5"	EMPTY		SUB4-HVAC2B-P	3/4"	3 #8 (P), 1 #8 (G)	
SUB4-207-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-HVAC2-COM	1"	1 VENDOR CABLE	
SUB4-207-F1	5"	3 #2 15kV RATED SHIELDED CABLE (P), 1 #4 (G)		SUB4-HVAC2C-P	3/4"	3 #8 (P), 1 #8 (G)	
SUB4-207-F2	5"	EMPTY		SUB4-HVAC3/4-C1	1-1/4"	14 #12 (C), 6 #12 (SP), 3 #12 (G)	
SUB4-208-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-HVAC3/4-C2	1-1/2"	16 #12 (C), 8 #12 (SP), 4 #12 (G)	
SUB4-208-F1	5"	EMPTY		SUB4-HVAC3-C	3/4"	6 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-208-F2	5"	EMPTY		SUB4-HVAC3-P	3/4"	3 #10 (P), 1 #10 (G)	
SUB4-303-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-HVAC3SD-C	3/4"	2 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-304-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-HVAC4-C	3/4"	6 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-305-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		SUB4-HVAC4-P	3/4"	3 #10 (P), 1 #10 (G)	
SUB4-305-F1	5"	3 500 kCMIL 5kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		SUB4-HVAC4SD-C	3/4"	2 #12 (C), 2 #12 (SP), 1 #12 (G)	
SUB4-305-F2	5"	3 500 kCMIL 5kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		SUB4-MCP1-G	2"	2 250 kCMIL (G)	
SUB4-305-F3	5"	3 500 kCMIL 5kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		OMMITTED			
SUB4-305-F4	5"	EMPTY		OMMITTED			
SUB4-305-F5	5"	EMPTY		OMMITTED			
SUB4-305-F6	5"	EMPTY		OMMITTED			
SUB4-403-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		OMMITTED			
SUB4-404-C	1-1/4"	13 #12 (C), 4 #12 (C), 1 #12 (G)		OMMITTED			
SUB4-405-C	1-1/4"	17 #12 (C), 6 #12 (SP), 1 #12 (G)		OMMITTED			
SUB4-405-F1	5"	3 500 kCMIL 5kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		OMMITTED			
SUB4-405-F2	5"	3 500 kCMIL 5kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		OMMITTED			
SUB4-405-F3	5"	3 500 kCMIL 5kV RATED SHIELDED CABLE (P), 1 250 kCMIL (G)		OMMITTED			
SUB4-405-F4	5"	EMPTY		OMMITTED			
SUB4-405-F5	5"	EMPTY		OMMITTED			
SUB4-405-F6	5"	EMPTY		OMMITTED			
SUB4-AITC1-C	3/4"	4 #12 (C), 2 #12 (SP), 1 #12 (G)		SUB4-PNL1/2-COM	4"	2 TYPE II FIBER OPTIC CABLE(S) (COM)	
SUB4-AITC1501-I1	3/4"	2 VENDOR CABLE (I)					
SUB4-AITC1501-I2	3/4"	1 #16 2-CONDUCTOR TWISTED PAIR SHIELDED CABLE (I), 1 #16 2-CONDUCTOR TWISTED PAIR SHIELDED CABLE (I), 1 #12 (G)					



C	10/13/2020	ADDENDUM 4
B	10/07/2020	ADDENDUM 3
A	07/13/2020	ISSUED FOR BIDS
ISSUE	DATE	DESCRIPTION

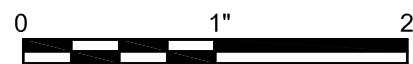
PROJECT MANAGER	HEI
DESIGNED BY	HEI
DRAWN BY	HEI
CHECKED BY	HEI
DATE	10/13/2020
PROJECT NUMBER	10123906



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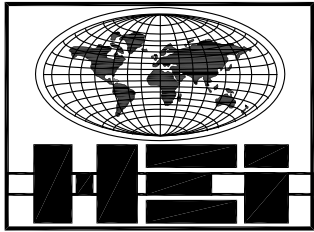
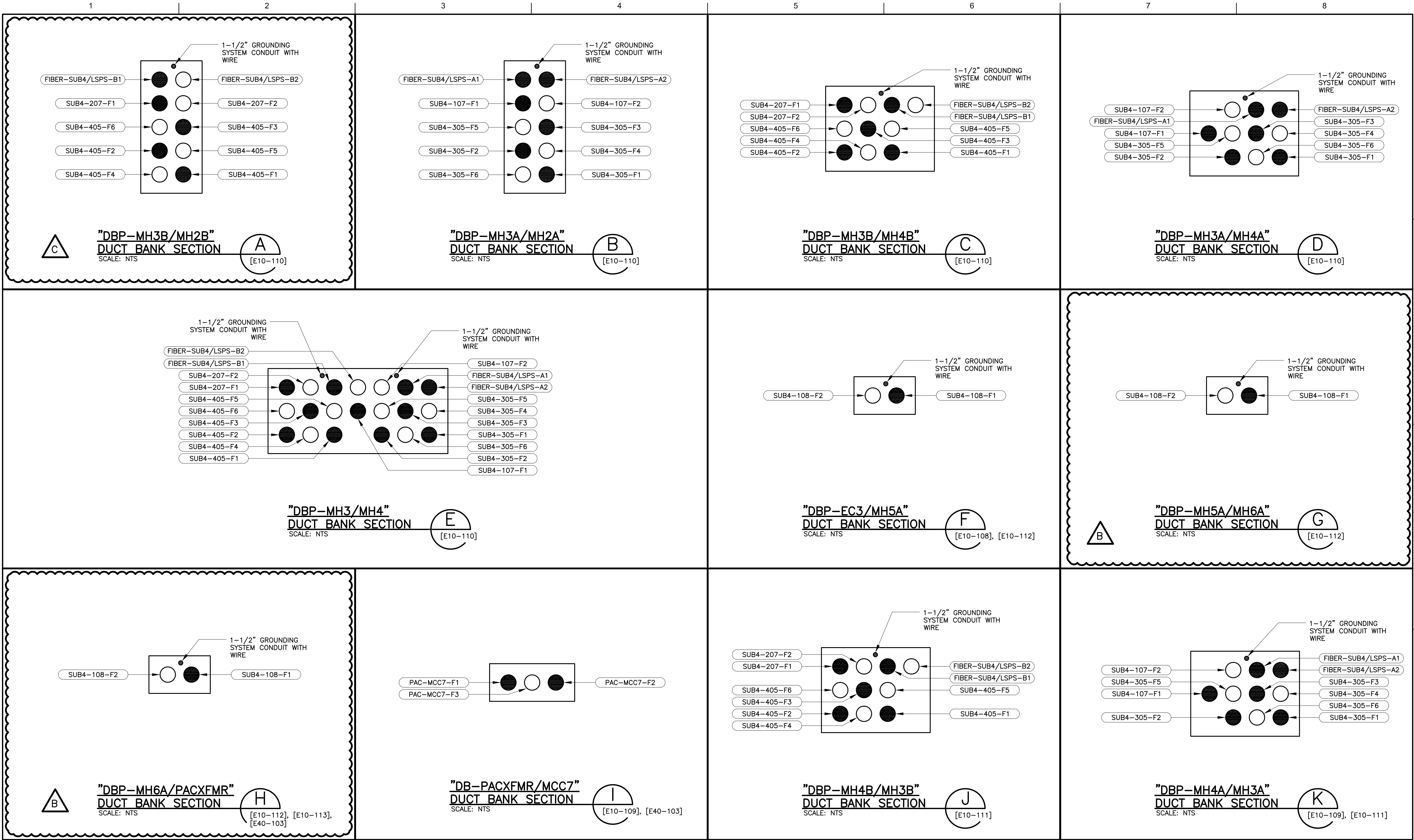
ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL



FILENAME | -
SCALE | NTS

SHEET
E00-008

CONDUIT AND WIRE SCHEDULE
RENOVATION (2 OF 3)



HARUTUNIAN ENGINEERING INC
TEXAS FIRM REGISTRATION NUMBER F-2408
ENGINEERING AND ENVIRONMENTAL CONSULTANTS
8100 CROSS PARK DRIVE
AUSTIN, TEXAS 78754



Texas P.E. Firm
Registration No. F-754

ISSUE	DATE	DESCRIPTION
C	10/13/2020	ADDENDUM 4
B	10/07/2020	ADDENDUM 3
A	07/13/2020	ISSUED FOR BIDS

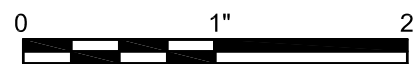
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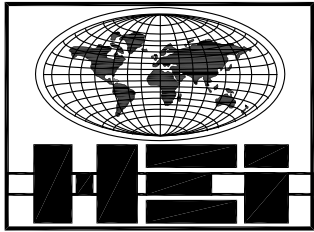
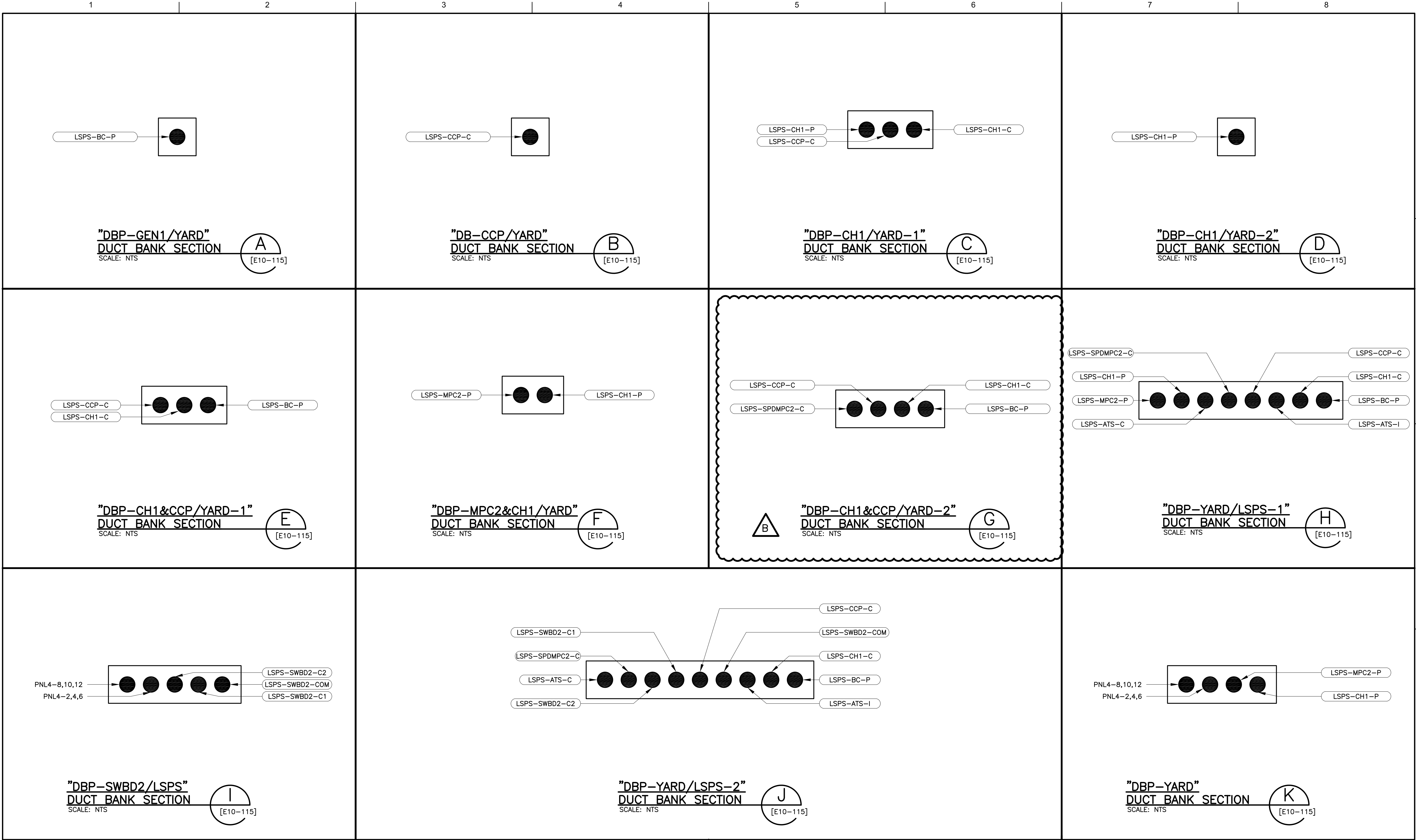
ULLRICH WTP LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL



FILENAME -
SCALE AS SHOWN

SHEET
E10-304

DUCT BANK SECTIONS PROPOSED (4 OF 9)



HARUTUNIAN ENGINEERING INC.
TEXAS FIRM REGISTRATION NUMBER F-2408
ENGINEERING AND ENVIRONMENTAL CONSULTANTS
8100 CROSS PARK DRIVE
AUSTIN, TEXAS 78754



Texas P.E. Firm
Registration No. F-754

B	10/13/2020	ADDENDUM 4
A	07/13/2020	ISSUED FOR BIDS
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	HEI
DESIGNED BY	HEI
DRAWN BY	HEI
CHECKED BY	HEI
DATE	10/13/2020
PROJECT NUMBER	10123906

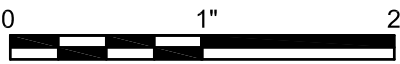


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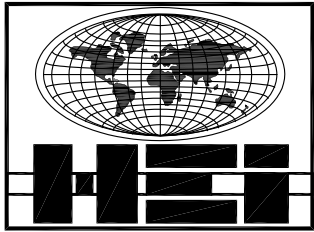
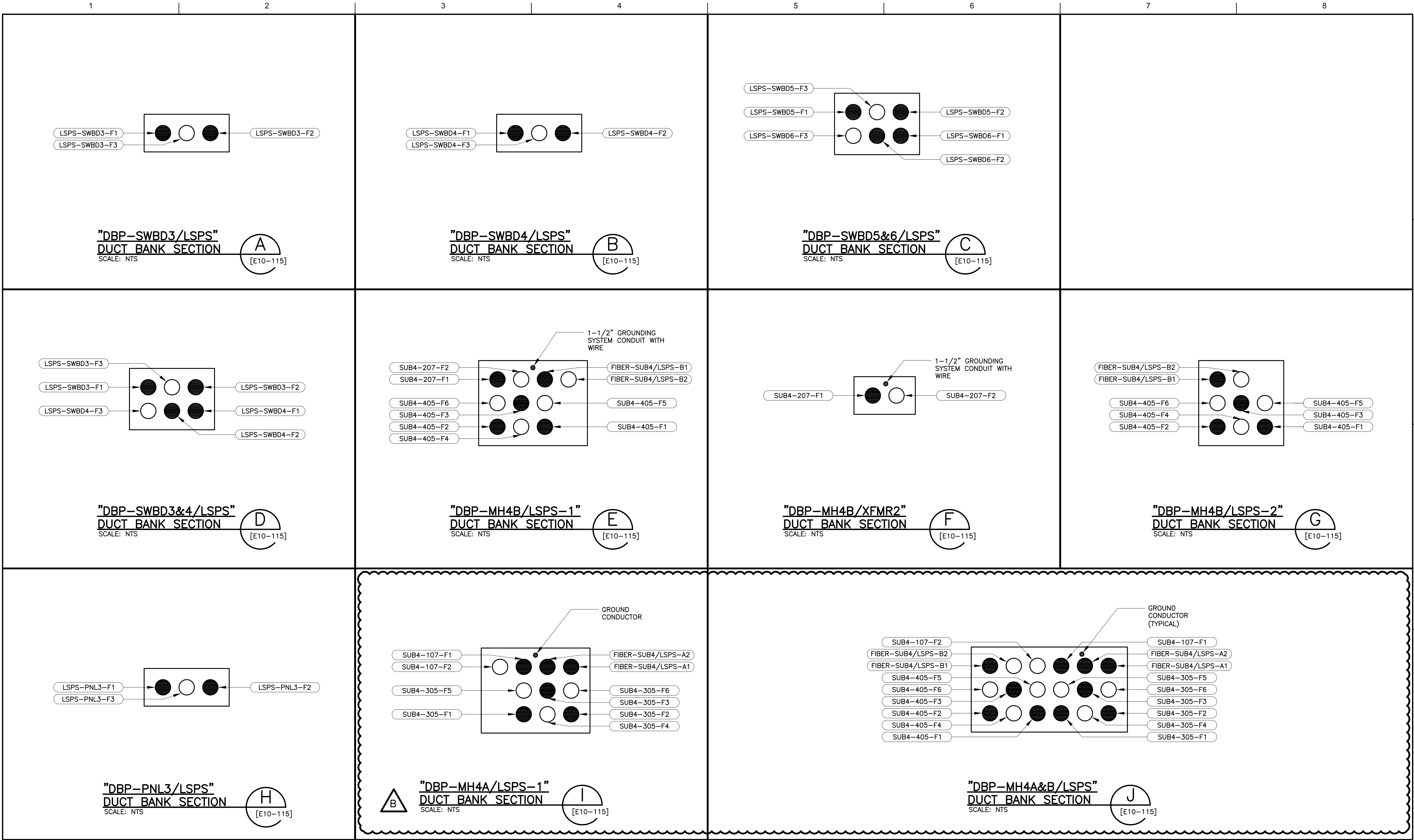
ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL

DUCT BANK
SECTIONS
PROPOSED (6 OF 9)



FILENAME | -
SCALE | AS SHOWN

SHEET
E10-306



HARUTUNIAN ENGINEERING INC.
TEXAS FIRM REGISTRATION NUMBER F-2408
ENGINEERING AND ENVIRONMENTAL CONSULTANTS
8100 CROSS PARK DRIVE
AUSTIN, TEXAS 78754



Texas P.E. Firm
Registration No. F-754

ISSUE	DATE	DESCRIPTION
B	10/13/2020	ADDENDUM 4
A	07/13/2020	ISSUED FOR BIDS

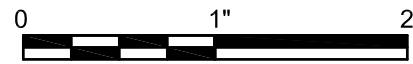
PROJECT MANAGER	HEI
DESIGNED BY	HEI
DRAWN BY	HEI
CHECKED BY	HEI
DATE	10/13/2020
PROJECT NUMBER	10123906



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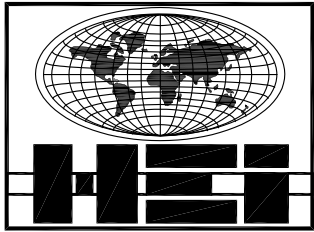
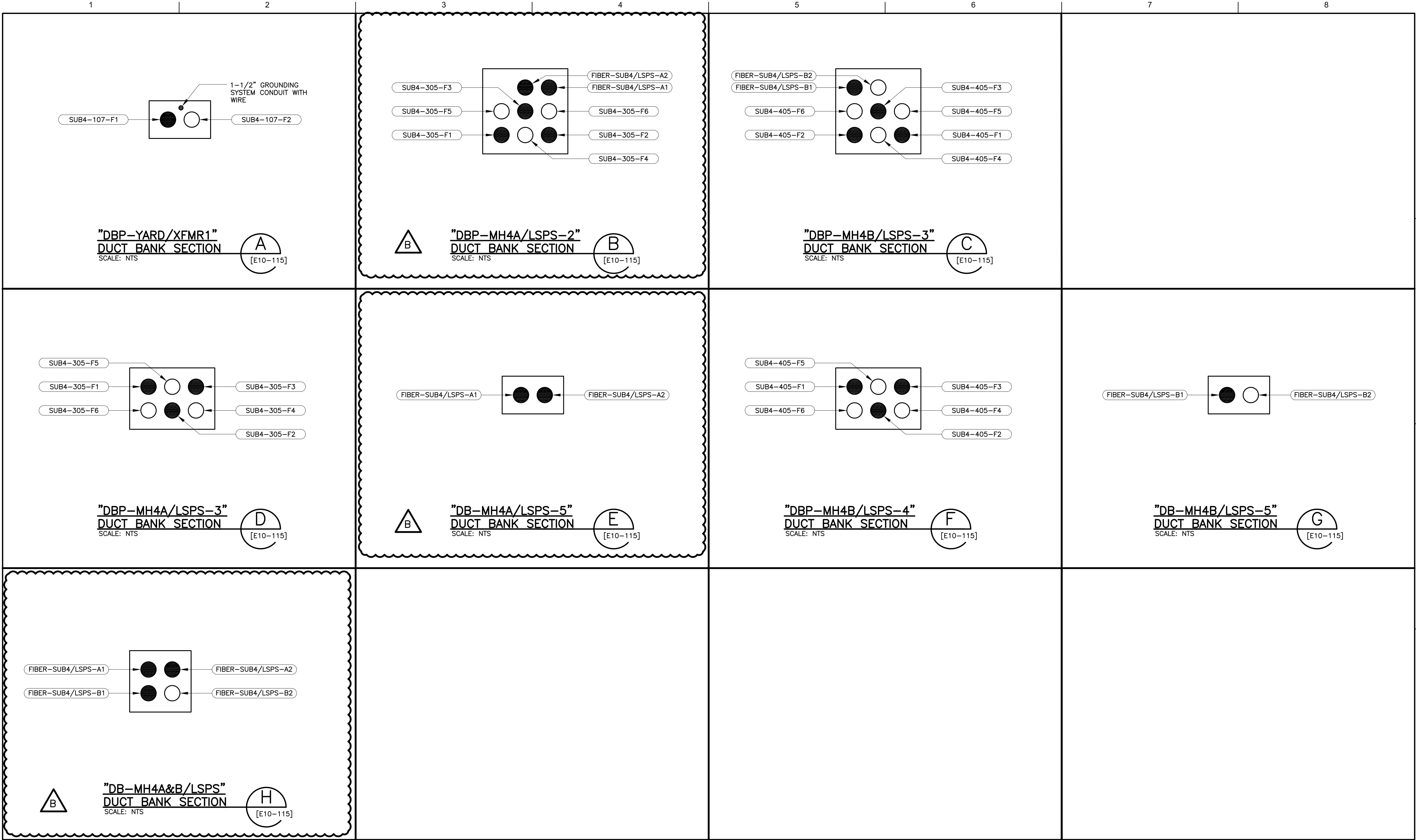
ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL



FILENAME: -
SCALE: AS SHOWN

DUCT BANK
SECTIONS
PROPOSED (8 OF 9)

SHEET
E10-308



HARUTUNIAN ENGINEERING INC
TEXAS FIRM REGISTRATION NUMBER F-2408
ENGINEERING AND ENVIRONMENTAL CONSULTANTS
8100 CROSS PARK DRIVE
AUSTIN, TEXAS 78754



Texas P.E. Firm
Registration No. F-754

ISSUE	DATE	DESCRIPTION
B	10/13/2020	ADDENDUM 4
A	07/13/2020	ISSUED FOR BIDS

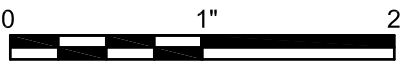
PROJECT MANAGER	HEI
DESIGNED BY	HEI
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DATE	10/13/2020
PROJECT NUMBER	10123906



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ULLRICH WTP
LOW SERVICE PUMP STATION
ELECTRICAL FEED RENEWAL



FILENAME -
SCALE AS SHOWN

SHEET
E10-309

DUCT BANK
SECTIONS
PROPOSED (9 OF 9)